

*Draft 2022 303(d) Assessment  
Methods*



UTAH DEPARTMENT of  
ENVIRONMENTAL QUALITY  
**WATER  
QUALITY**

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## Abbreviations

<b>Abbreviation</b>	<b>Definition</b>
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to
AGRC	Automated Geographic Reference Center
ATTAINS	The Assessment, Total Maximum Daily Load, Tracking and Implementation System. This EPA-maintained database is an online system for accessing information about the conditions of the Nation's surface waters.
AU	assessment unit
Ca	calcium
CFR	Code of Federal Regulations
Chl-a	chlorophyll a
CWA	Clean Water Act
DEQ	Utah Department of Environmental Quality
DO	dissolved oxygen
DWQ	Utah Division of Water Quality
E	expected
E. coli	Escherichia coli
EPA	U.S. Environmental Protection Agency
ER	ecosystem respiration
g	grams

GIS	geographic information systems
GPP	gross primary productivity
GSL	Great Salt Lake
GRAMA	Government Records Access and Management Act
HAB(s)	harmful algal bloom(s)
HH	human health
HUC	hydrologic unit
IR	Integrated Report
kg	kilogram
L	liter
Mg	magnesium
mg	milligram
mg/kg	milligram per kilogram
mg/L	milligram per liter
mL	milliliter
MLID	monitoring location identifier
MPN	most probable number
NHD	National Hydrologic Dataset
O	observed
O/E	observed/expected
Pc	probability of capturing
ppm	parts per million

QA	quality assurance
QA/QC	quality assurance/quality control
QC	quality control
QAPP	quality assurance project plan
RIVPACS	River Invertebrate Prediction and Classification System
SAP(s)	sample analysis plan(s)
SD	standard deviation
SDD	Secchi disk depth
SOP(s)	standard operating procedure(s)
T	temperature
TDS	total dissolved solids
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
TSI	trophic state index
UAC	Utah Administrative Code
UDOH	Utah Department of Health
USGS	U.S. Geological Survey
WMU	watershed management unit
WQP	(EPA's) Water Quality Portal
WQS	water quality standard
µg/L	microgram per liter

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# Introduction

## ***THE CLEAN WATER ACT AND THE INTEGRATED REPORT***

The rules and regulations of the federal Clean Water Act (CWA) require the Utah Division of Water Quality (DWQ) to report the condition or health of all Utah surface waters to the U.S. Congress every other year. The Integrated Report (IR) contains two key reporting elements defined by the CWA:

**Statewide reporting under CWA Section 305(b):** Section 305(b) reporting summarizes the overall condition of Utah’s surface waters and estimates the relative importance of key water quality concerns. These concerns can include pollutants, habitat alteration, and sources of water quality problems.

**Water quality assessments under CWA Section 303(d):** Section 303(d) requires states to identify waters that are not supporting beneficial uses according to state water quality standards (Utah Administrative Code [UAC] [R317-2-7.1](#)). Utah’s Section 303(d) list (hereafter the 303(d) list) also prioritizes the total maximum daily loads (TMDL) required for each listed waterbody and the cause of nonattainment. This list includes waters impaired as a result of nonpoint sources, point source discharges, natural sources, or a combination of sources.

In addition to Utah’s 303(d) list, DWQ also identifies

- Waterbodies meeting water quality standards
- Waterbodies with water quality problems that DWQ cannot confirm due to insufficient sample size, uncertainty regarding the nature of the data or other factors
- Waterbodies either currently addressed by DWQ through a TMDL or other pollution-control mechanism

Full descriptions of these and other U.S. Environmental Protection Agency (EPA)-identified waterbody assessment classifications are described and summarized in Table 1.

## ***ASSESSMENT CATEGORIES FOR SURFACE WATERS***

DWQ uses five categories defined by EPA to assess surface waters of the state (EPA, 2005). These categories are described in Table 1.

Table 1. U.S. Environmental Protection Agency categorization of assessed surface waterbodies for Integrated Report purposes.

EPA Assessment Category	Assessment Category Description
1	<b>Supporting.</b> All beneficial uses assigned to a waterbody are evaluated against one or more numeric criteria and each use is found to meet applicable water quality standards.
2	<b>No Evidence of Impairment.</b> Some, but not all, beneficial uses assigned to a waterbody are evaluated against one or more numeric criteria, and each assessed use is found to meet applicable water quality standards.
3	<b>Insufficient Data and/or Information.</b> There are insufficient data and information to conclude support or nonsupport of a use. The category may be applied when: (1) the dataset is smaller in size and has water quality criteria exceedances OR no water quality criteria exceedances; (2) a secondary review applied to a waterbody found it was not meeting water quality standards; (3) water quality criteria and/or beneficial use support assessment methods are not yet developed (or are undergoing development or revisions) so use attainment has not been determined; (4) waterbodies were assessed against water quality parameters and characteristics that require further investigations as defined in <a href="#">UAC R317-2</a> ; (5) assessment units (AUs) have improper use designations, lack use designations, or contain other inconsistencies in the dataset. In cases where no recent data are available, historic-listing determinations will be maintained.
4A	<b>TMDL-Approved.</b> Waterbodies impaired by a pollutant with a TMDL(s) developed and approved by EPA. Where more than one pollutant is associated with the impairment, the waterbody and the parameters that have an approved TMDL are listed in this category. If a waterbody has other pollutants that need a TMDL, the waterbody is listed in Category 5 with an Approved TMDL.
4B	<b>Pollution Control.</b> Waterbodies that are not supporting designated uses where other pollution-control requirements, such as best management practices required by local, state, or federal authority, are stringent enough to bring the waters listed in this category back into attainment in the near future with the approved pollution-control requirements in place, consistent with 40 Code of Federal Regulations (CFR) 130.7(b) (I) (ii) and (iii). All waterbodies placed in this category must have a pollution control requirement plan developed and approved by EPA. Similar to Category 4A, if the waterbody has other pollutants that need a TMDL, or there is already a TMDL in place for another pollutant, the waterbody may also be listed in Categories 5 and 4A. Therefore, an AU with a pollution control in place may be listed in Categories 4B, 4A, and 5.
4C	<b>Non-Pollutant Impairment.</b> Waterbodies not supporting designated uses are placed in this category if the impairment is not caused by a pollutant but rather by pollution (for example, hydrologic modification or habitat degradation). Similar to Categories 4A and 4B, if the waterbody has other pollutants that need a TMDL, or there is an approved TMDL or pollution-control mechanism in place, the waterbody may also be listed in Categories 4A, 4B, and 5. Therefore, an AU with a pollution control in place may be listed in Categories 4C, 4B, 4A, and 5.
5	<b>Not Supporting.</b> The concentration of a pollutant or several pollutants exceeds numeric water quality criteria, or beneficial uses are not-supporting based on violation of the narrative water quality standards. Waterbodies identified as “threatened” may also be placed in this category. In a “threatened” waterbody, one or more of its uses are likely to become impaired by the next IR cycle and water quality may be exhibiting a deteriorating trend if pollution control actions are not taken. Both impaired and threatened waterbodies constitute Utah’s formal Section 303(d) list and are prioritized for future TMDL development.
5-Alt	<b>TMDL Alternatives.</b> The <a href="#">303(d) program vision</a> promotes the identification of alternative approaches to TMDL development for impaired waters where these approaches would result in a more rapid attainment of water quality standards. Note: This category is referenced in DWQ’s “303(d) Vision Document.”

## UTAH'S NUMERIC CRITERIA AND BENEFICIAL USES

DWQ assesses the impacts of measured pollutant concentrations on environmental and human health to determine the appropriate assessment categories for a waterbody (see Table 1). Utah has developed and adopted water quality numeric criteria (chemical concentrations that should not be exceeded) to protect the water quality of surface waters and the uses these waterbodies support ([UAC R317-2-14](#)). As noted in [UAC R317-2-14](#), the water quality criteria for a pollutant can vary depending on the beneficial use assigned to a waterbody.

Utah adopted beneficial use classifications that identify the use and value of a waterbody for source water for domestic water systems, aquatic wildlife, recreation, agriculture, and Great Salt Lake (see [UAC R317-2-6](#)). DWQ currently designates five beneficial use classes of surface waters within the state:

- Class 1. Protected for use as a raw water source for domestic water systems
- Class 2. Protected for recreational use and aesthetics
- Class 3. Protected for use by aquatic wildlife
- Class 4. Protected for agricultural uses including irrigation of crops and stock watering
- Class 5. The Great Salt Lake (GSL)

Subclassifications for several of these categories are further defined in Table 2.

**Table 2. Subclassifications of Utah's beneficial uses.**

Beneficial Use Subclassification	Use Definition
1C*	Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water
2A	Protected for frequent primary contact recreation where there is a high likelihood of ingestion of water or a high degree of bodily contact with the water. Examples include, but are not limited to, swimming, rafting, kayaking, diving, and water skiing.
2B	Protected for infrequent primary contact recreation. Also protected for secondary contact recreation where there is a low likelihood of ingestion of water or a low degree of bodily contact with the water. Examples include, but are not limited to, wading, hunting, and fishing.
3A*	Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain.
3B*	Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain.
3C*	Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.
3D*	Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
3E*	Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.
4	Protected for agricultural uses including irrigation of crops and stock watering.
5A	<b>Gilbert Bay</b> Geographical Boundary: All open waters at or below approximately 4,208-foot elevation south of the Union Pacific Causeway, excluding all of the Farmington Bay south of the Antelope Island Causeway and salt evaporation ponds. Beneficial Uses: Protected for frequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.

Beneficial Use Subclassification	Use Definition
5B	<b>Gunnison Bay</b> Geographical Boundary: All open waters at or below approximately 4,208-foot elevation north of the Union Pacific Causeway and west of the Promontory Mountains, excluding salt evaporation ponds. Beneficial Uses: Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
5C	<b>Bear River Bay</b> Geographical Boundary: All open waters at or below approximately 4,208-foot elevation north of the Union Pacific Causeway and east of the Promontory Mountains, excluding salt evaporation ponds. Beneficial Uses: Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
5D	<b>Farmington Bay</b> Geographical Boundary: All open waters at or below approximately 4,208-foot elevation east of Antelope Island and south of the Antelope Island Causeway, excluding salt evaporation ponds. Beneficial Uses: Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
5E	<b>Transitional Waters along the Shoreline of the Great Salt Lake</b> Geographical Boundary: All waters below approximately 4,208-foot elevation to the current lake elevation of the open water of the Great Salt Lake receiving their source water from naturally occurring springs and streams, impounded wetlands, or facilities requiring a UPDES permit. The geographical areas of these transitional waters change corresponding to the fluctuation of open water elevation. Beneficial Uses: Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.
<b>*Footnote: There are human health (HH) criteria associated with these beneficial uses (see <a href="#">UAC R317-2-14</a>). For uses with a HH criteria, (see Table 2.14.6 in <a href="#">UAC R317-2-14</a>), the following use notation will be used in 303(d) data and assessment reports: HH1C, HH3A, HH3B, HH3C, and HH3D.</b>	

Every beneficial use with numeric criteria and credible and readily available data is assessed and reported for 303(d) assessment purposes. DWQ does not just assess and report on the most environmentally protective criterion and/or use for a parameter and waterbody. Where waterbodies are unclassified and do not have assigned beneficial uses in DWQ data records, DWQ may assign default beneficial uses as articulated in [UAC R317-2-13.9, 13.10, 13.11, 13.12, and 13.13](#). Alternately, these undefined waterbodies may be classified as an EPA Assessment Category 3 or not reported in the IR if an Assessment Unit has not been established.

For more information on how DWQ develops, adopts, and updates the numeric criteria and beneficial uses in [UAC R317-2](#), please refer to DWQ's [Standards](#) website.

### **PRIORITY AND ASSESSED PARAMETERS**

DWQ developed a priority parameter list for routine water quality monitoring to make the list of pollutants with numeric criteria in [UAC R317-2-14](#) more manageable for monitoring and assessment purposes. This priority list is a subset of the pollutants listed in [UAC R317-2-14](#) and reflects the following constraints:

- Laboratory resources that limit the ability to assess all parameters in [UAC R317-2-14](#)
- Significant monitoring and/or analytical costs associated with processing a sample or measuring a pollutant
- Logistical constraints due to monitoring location and holding times for certain parameters

As a result, water quality assessments may not report on all parameters listed in [UAC R317-2-14](#). Instead, assessments reflect all parameters with adopted numeric criteria that also have readily available and credible datasets from the IR period of record.

To view DWQ's list of priority parameters, please refer to

Appendix 1. Please be aware that priority parameters can change from one reporting cycle to the next if laboratory and financial constraints and monitoring priorities within a sampling area change.

# Assessment Process and Time Frames

## ***DEVELOPING THE METHODS***

This document describes the most up-to-date assessment methods that will be applied to Utah's current IR cycle. Although most of the methods described have been applied in past assessment cycles, other methods are new or modified from previous reporting cycles. Some of the assessment method revisions are intended to clarify ongoing DWQ practices. Other more substantive revisions may be based on comments that were raised during the previous IR's 303(d) assessment methods and draft IR public comment periods.

DWQ updates and revises the 303(d) methods when concerns are raised or when program developments are released by DWQ. Additional modifications or clarifications to the assessment methods may also be made based on feedback provided by EPA during and after a reporting cycle or from the [EPA's cycle-specific 303\(d\) guidance memorandum](#).

All changes made to the 303(d) assessment methods are typically reviewed and updated on even-numbered years in anticipation of developing the Draft IR and 303(d) list in the following odd-numbered year. This process allows DWQ to consider comments and suggestions on assessment methods before a formal analysis is conducted. This reduces the need to rework analyses from changes in methods. In the 2022 IR cycle, however, methods will be reviewed and updated in an odd-numbered year in time for an even-numbered year submission for EPA approval.

## ***PUBLIC REVIEW OF THE METHODS PROCESS AND SCHEDULE***

The development and acceptance of the Assessment Methods includes a public review process and occurs on the following schedule:

- a. DWQ releases the proposed Assessment Methods for a 30-day public comment period. The notice for public comments on the Assessment Methods are advertised on [DWQ's News and Announcements](#) webpage, DWQ's [Public Notices](#) webpage, and [Utah's Integrated Report program](#) webpages.
- b. DWQ compiles and responds to the comments received within the 30-day public comment period. DWQ's responses to comments are posted on the [Utah's Integrated Report program](#) webpages.
- c. If substantial revisions to the Assessment Methods are adopted by DWQ based on comments received in the public comment period, DWQ has the discretion to hold a second public comment period of 30 days or less. Should DWQ proceed with a second public comment period, notifications will be advertised, at a minimum, on [DWQ's News and Announcements](#) and/or [Public Notices](#) webpages, and the [Utah's Integrated Report program](#) webpages.
- d. Following the conclusion of the public comment period(s), DWQ posts responses to comments on the [Utah's Integrated Report program](#) webpages. Any changes or additions that were made in response to public comments will be documented and issued with the draft IR and 303(d) list. If stakeholders have concerns with the final Assessment Methods released during the draft IR, the public should submit their comments during the next IR cycle, when future calls for public comments on the Assessment Methods are issued.

Concerns and comments not received through the above processes may not be considered for current and future 303(d) methods updates and modifications.

## ***CALL FOR READILY AVAILABLE DATA AND SCHEDULE***

DWQ issues a request for all readily available data (i.e., the IR Call for Data) after November 1 of even-numbered years.

### **Existing and Readily Available Data Defined**

DWQ assembles and evaluates all existing and readily available data to determine whether a waterbody is supporting or not supporting the assigned beneficial uses and numeric criteria in [UAC R317-2](#) as mandated in [40 CFR 130.7\(b\)\(5\)](#). For the purposes of the IR, existing and readily available data may include:

- Data and information referenced in [40 CFR 130.7\(b\)\(5\)\(i\),\(iii\), and \(iv\)](#)
- Data collected by DWQ or DWQ cooperators for assessment purposes
- Data collected for other DWQ programs, such as waste load allocations, TMDL development, watershed planning, and use attainability analyses
- Data collected for narrative assessments (see Narrative Assessment: Biological Assessments and Narrative Standards for All Waters)
- Data obtained through [EPA's Water Quality Portal](#) (WQP)
- Data and information obtained through the IR's public [Call for Data](#)
- Data and information submitted to EPA's Water Quality Exchange System or DWQ's Call for Data to support a credible data submission (e.g., Tables 5-8)
- Data included in the Data Types Matrix in Table 10

Data and information (as described above) that are not brought forward during the IR's [Call for Data](#) or presented to DWQ in accordance with the schedule as outlined in this document and on [Utah's Integrated Report program webpages](#) will not be treated as readily available for the purpose of assessment decisions during the current assessment cycle.

Data that are submitted to DWQ or obtained by DWQ during the IR data compilation process are integrated into DWQ's assessments as described in Table 3 and subject to DWQ's data management and quality assurance/quality control (QA/QC) processes. Should any data and information not be included in the assessment process, DWQ will clearly document which dataset (or datasets) were not included and why (as described and required in [40 CFR 130.7\(b\)\(6\)\(iii\)](#)).

Table 3. DWQ's data-availability matrix.

Data Availability	Description	Processing required	Uses for Assessments
<p><b>Readily available</b></p>	<p>Data are incorporated into <a href="#">EPA's WQP database</a> and can interface directly with DWQ's IR data processing and assessment tools.</p> <p>Data is submitted by stakeholders or data submitters through DWQ's data submission templates or electronic submission processes which are provided on the <a href="#">Call for Data</a> webpage.<sup>1,2</sup></p>	<p>None</p>	<p>Fully incorporate into DWQ's assessment tools</p>
	<p>Additional "other" sources of data included in the Data Types Matrix in Table 10 that described the waterbodies in <a href="#">40 CFR 130.7(b)(5)(i), (iii), and (iv)</a> and are submitted through DWQ's electronic submission process as described on the <a href="#">Call for Data</a> webpage.</p>	<p>None</p>	<p>Fully incorporate into DWQ's Conflicting Assessments of Water Quality Standards and Secondary Review processes</p>
<p><b>Readily available (additional processing may be required by DWQ)</b></p>	<p>Quantitative data and information may be stored in and routinely uploaded to a queryable, regularly maintained database that is available on the web or electronically submitted to DWQ during the public call for data. Database format is consistent and allows repeatable queries with predictable results (e.g., parameter names, location descriptions, and parameter units are consistent), making development of automated interface tools practicable.</p>	<p>Full incorporation into IR assessment tools requires DWQ development of interface tools for aggregating, translating, and harmonizing data to appropriate formats. In particular, sampling locations and dates, parameter names, fractions, units, analysis methods, and detection limits require translation and interpretation prior to assessment.</p>	<p>Fully incorporate into IR assessment tools if interface tools have been developed.<sup>2</sup></p> <p>If interface tools are still in the development phase, (1) screen data for exceedances for the waterbodies described in <a href="#">40 CFR 130.7(b)(5)(i), (iii), and (iv)</a>, or (2) manually assess data for specific sites, dates, and parameters at the request of stakeholders or data submitters for waterbodies described in <a href="#">40 CFR 130.7(b)(5)(i), (iii), and (iv)</a>. Results are fully incorporated into DWQ's Conflicting Assessments of Water Quality Standards and Secondary Review.</p>

Data Availability	Description	Processing required	Uses for Assessments
<p><sup>1</sup> DWQ data submission templates and processes are designed to allow for data and information that may not fit the data structure of EPA's Water Quality Exchange System. They may also be used to support a credible data review (Tables 5-8) or perform narrative or high frequency data assessments.</p>			
<p><sup>2</sup> DWQ requests data submitters inform the Division which data system contains their data so DWQ can work with submitters prior to the IR's Call for Data to develop interface tools.</p>			

## ***DEVELOPING THE COMPONENTS OF THE DRAFT INTEGRATED REPORT AND 303(D) LIST***

DWQ reviews all data and assigns a credible data “grade” following its response to public comments on the draft 303(d) Assessment Methods and compilation of all existing and readily available data. All non-rejected, credible data are then assessed. The final 303(d) Assessment Methods, 305(b) Summary, and 303(d) List of Impaired Waters are the minimum reporting elements included in the Integrated Report. These reporting elements are available for public review and comment.

### **Final 303(d) Assessment Methods**

The final version of the publicly-vetted 303(d) Assessment Methods, including any changes or additions made in response to the Assessment Method public comment period(s) is posted on the [Utah's Integrated Report program webpages](#).

### **305(b) Summary**

This summary, at a minimum, will address the following elements for current assessments and previous assessments where new data and information did not result in an EPA-defined categorical change:

- A unique identifier assigned to the Assessment Unit
- The name and location description of the Assessment Unit
- An indicator of whether the Assessment Unit is currently active, or if the Assessment Unit identifier was retired and being kept for historical tracking purposes and is part of an Assessment Unit history of another Assessment Unit
- The geographic state within which the Assessment Unit is contained
- The waterbody type for the Assessment Unit
- The size and the unit of measure for the assessed waterbody type
- The EPA-defined assessment category for each defined and evaluated Assessment Unit

### **303(d) Assessment Results**

At a minimum, the following information will be provided for current assessments and previous assessments where new data and information did not result in an EPA-defined categorical change:

- The minimum elements discussed above in the Utah's Integrated Report program webpages.
- 305(b) Summary
- The cycle the Assessment Unit was last assessed, which can include any conclusions related to this Assessment Unit and delisting decisions (if appropriate)
- The beneficial use(s) designated to the Assessment Unit and the EPA-defined assessment categories associated with the beneficial use after assessment
- The name of the parameter assessed, the beneficial use associated with the assessed parameter, and the EPA-defined assessment category status for the parameter and beneficial use
- An indicator of the water quality trend representing the beneficial use or parameter assessment
- A flag indicating whether or not the cause of the attainment status is a pollutant
- The agency responsible for identifying the EPA-defined assessment category status for the waterbody
- The IR cycle the Assessment Unit was first listed for a cause
- The name of the source of the EPA-defined assessment category status and if that source has been confirmed
- The reason(s) and the agency responsible for identifying the delisting of a waterbody and cause

### 305(b) Summary and 303(d) Assessment Metadata

DWQ will provide (at a minimum) the following supporting information and documentation as referenced in CFR 130.7 (b)(6) to support its decision to list or not list waters:

- A description of, and access to, the data records and information used in the IR's current period of record
- A rationale for, and access to, any data and information that was obtained or submitted to DWQ during the call for data but did not meet DWQ's readily available or credible data requirements and was not used for 305(b) and 303(d) assessments
- A rationale for, and access to, any rejected data records and information

For archiving purposes and to assist with the review of the IR and 303(d) List, DWQ will also provide the following as time and resources allow:

- The assessment method type and the assessment method context as defined in [ATTAINS](#)
- Geolocation information on the waterbodies assessed
- The date and version of [UAC R317-2](#) used in the assessment cycle
- The list of approved TMDLs used in the assessment cycle
- A fact sheet summarizing the Final IR results

Note: In odd-numbered years, DWQ will "freeze" and establish file versions of several working files to maintain consistency and data integrity. These files include geographic information system (GIS) point files of monitoring locations, layers of AUs, beneficial uses, and water quality standards.

### ***PUBLIC REVIEW OF THE 303(D) LIST***

There will be a formal public review process for the IR and 303(d) list using the following steps:

- a. Any person who has a pollution-control mechanism plan for a waterbody and would like to submit that plan for consideration and EPA approval as a Category 4B must submit that information to DWQ by July 1 of even-numbered years (Appendix 5). If approved by DWQ, this information will then be submitted to EPA for review and final approval. It should be noted, however, that it takes a long time for successful Category 4B determinations to receive EPA approval and they may not be received in time to be included in the current IR cycle.
- b. Waters and pollutants that are considered for a potential Category 4A (approved TMDLs) must be approved by DWQ's Water Quality Board per [UAC R317-1-7](#) and by EPA per [40 CFR 130.7](#) by September 30 of even-numbered years. TMDLs that are approved by DWQ and EPA after that date will be considered in future IRs.
- c. DWQ will release the proposed IR and 303(d) list for a 30-day public comment period after July 1 of odd-numbered years and no later than February 1 of even-numbered years. At a minimum, the notice for public comments on the IR will be advertised on [DWQ's News and Announcements](#) and/or [Public Notices](#) webpages, and the [Utah's Integrated Report program](#) webpages.
- d. Stakeholders who wish to submit data for listing or delisting considerations are encouraged to submit that data and information during the Utah's IR program's [Call for Data](#). However, DWQ may consider data that are submitted during the public comment period of the draft IR and 303(d) list when the commenter can show that submitted data results could result in a change to a specific waterbody assessment decision. Data that are submitted during the public comment period for the draft IR must be submitted in the format articulated in this document and on the IR [Call for Data](#) website and be of Grade A or B quality to be used in an assessment decision (see the Data Quality Matrices on the IR [Call for Data](#) website). Information submitted during the public comment period will undergo a secondary review (see [Secondary Review](#) and Appendix 3).
- e. DWQ will compile and respond to comments that were received within the 30-day public comment period after the close of the public comment period.

- f. DWQ may offer a second public comment period of 30 days or fewer if substantial revisions to the IR and 303(d) list are adopted on the basis of comments received during the first public comment period. Should DWQ proceed with a second public comment period, notifications will be advertised, at a minimum, on DWQ's [News and Announcements](#) and/or [Public Notices](#) webpages, and the [Utah's Integrated Report program webpages](#).
- g. DWQ will submit a response to the public comments that were received during the 30-day public comment period and a final version of the IR and 303(d) list to EPA for final approval no later than April 1 of even-numbered years. DWQ will post a status update on the [Utah's Integrated Report program's webpages](#) to let stakeholders know that a final IR was submitted to EPA for final approval. Any concerns or rebuttals from stakeholders regarding the IR will not be considered for the recently submitted IR after the submission of the IR to EPA for final approval. If stakeholders continue to have concerns with the IR and 303(d) list, they should submit their comments during the next IR cycle.
- h. EPA has 30 days to approve or disapprove the 303(d) list after receiving DWQ's formal submission letter, IR chapters, 303(d) list, categorization of non-303(d) waterbodies, public comments received and DWQ's response to them, delisting tables and justifications, list of approved TMDLs/pollution-control mechanisms, and GIS files of all assessment results. If EPA disapproves a state 303(d) list, EPA has 30 days to develop a new list for the state, although historically EPA has rarely established an entire list for a state. EPA may also partially disapprove a list because some waters have been omitted, and EPA may add these waters to the state's list. If EPA's final approval of the IR takes longer than the timeframe identified above, DWQ will post updates on the [Utah's Integrated Report programs webpages](#).
- i. Any concerns and comments not received by DWQ through the above processes will not be addressed in the IR.

### ***FINALIZING THE INTEGRATED REPORT AND 303(D) LIST***

DWQ will release the following information on the [Utah's Integrated Report program webpages](#) following approval by EPA:

- A final version of 303(d) Assessment Methods, including the public comments received and DWQ's response to comments
- Final IR chapters and 303(d) lists, including public comments received, DWQ's response to comments, all assessment information considered and evaluated in the finalization of the IR and 303(d) list, and a GIS file of the final assessments and 303(d) list

EPA maintains a [database](#) of state IR results and TMDL status. Additional information not available on the [Utah's Integrated Report program's webpages](#) may be obtained through a [Government Records Access and Management Act request](#). These requests can be submitted at any time.

# Scope of the Assessment

## WATERS OF THE STATE

As defined in [UAC R317-1-1](#), DWQ characterizes waters of the state as follows:

*... all streams, lakes, ponds, marshes, watercourses, waterways, wells, springs, irrigation systems, drainage systems, and all other bodies or accumulations of water, surface and underground, natural or artificial, public or private, which are contained within, flow through, or border upon this state or any portion thereof, except that bodies of water confined to and retained within the limits of private property, and which do not develop into or constitute a nuisance, or a public health hazard, or a menace to fish and wildlife, shall not be considered to be "waters of the state" under this definition (Section 19-5-102).*

For 303(d) assessment purposes, DWQ reports on the following waterbodies:

- Flowing surface waters of the state
- Canals as identified in site-specific standards or named in the list of waters with designated use classifications in [UAC R317-2](#)
- Lakes, reservoirs, and ponds

All other waters are currently reported through other programs within DWQ. For more information on these waterbodies and their reports, please visit [DWQ's website](#).

## WATERBODY TYPES

Utah assesses surface waters of the state at the monitoring-site level and then summarizes the site-level assessments at a larger spatial scale (the Assessment Unit (AU) scale). DWQ uses the descriptions in Table 4 to determine appropriate assessment sites and categorize monitoring locations.

**Table 4. Assessed waterbody types used for categorizing monitoring locations.**

Assessed Waterbody Type	Description
Flowing surface waters of the state*	A surface body of water moving under gravity flow. Perennial, intermittent and ephemeral surface waters are included in this type. Springs and seeps are also included in this waterbody type, provided they are flowing and connect, contribute, or are influencing water quality in a downstream river or stream.
Canals (general, irrigation, transport, or drainage)*	A human-made water conveyance with flowing water. Note: Canals are only assessed when identified in the site-specific numeric criteria in <a href="#">UAC R317-2-14</a> or are named in the list of waters with designated use classifications in <a href="#">UAC R317-2-13</a> .
Lakes, reservoirs, and ponds*	An inland body of standing fresh or saline water that is generally too deep to permit submerged aquatic vegetation to take root across the entire body. This type may include expanded parts of a river or natural lake, a reservoir behind a dam, or a natural or excavated depression containing a waterbody without surface water inlet and/or outlet.
*Footnote: Sites associated with these waterbody types that have readily available and credible data are also subject to secondary reviews as described in the Secondary Review section and Appendix 3.	

## **ASSESSMENT UNITS**

### **Assessment Unit Delineation and Identification**

Surface waters identified for 303(d) assessments are delineated into discrete units called assessment units (AUs). AUs identify waters of the state assessed for support of their designated beneficial uses. Lakes, reservoirs, and ponds are delineated as individual AUs, and their size is reported in acres. Flowing surface waters of the state and canals are delineated by specific rivers or one or more surface water reaches in subwatersheds

### **Additional Guidelines for Delineating Assessment Units**

DWQ follows the guidelines listed below when delineating AUs for flowing surface waters of the state. The first two guidelines are fixed rules.

- The entire AU is within a single 8-digit USGS HUC.
- Each AU comprises reaches with identical designated beneficial use classifications. For example, a waterbody that has beneficial uses of Class 1C, 2B, and 3A in one portion and Class 2B and 3B in another portion would have at least two distinct AUs because of the difference in beneficial use classifications.
- Large flowing surface waters of the state, such as the Green River, Colorado River, and portions of other large rivers (e.g., the Bear River and Weber River) are delineated into "linear" or "ribbon" AUs containing no tributaries. Where a major tributary enters these rivers, or hydrological features such as dams exist, the river is further delineated into two or more AUs.
- Tributaries and headwaters were delineated primarily using the 5th- and 6th-level HUC boundaries to define the AUs.
- Additional AUs were defined by combining or splitting 5th- or 6th-level watersheds using hydrological and ecological changes such as geology, vegetation, or land use.
- Small tributaries to larger flowing surface waters that could not be incorporated into a watershed unit are combined into separate, unique AUs.
- AU boundaries generally follow hydrologic units, but may also be delineated to reflect beneficial use designation changes, major tributaries or other observed hydrologic or chemical changes, administrative boundaries such as at some U.S. Forest Service boundaries, or notable road crossings as stated in water quality standards at [UAC R317-2-13](#).

Individual AUs for flowing surface waters of the state are assigned a unique identification code for indexing. Each AU identifier begins with the prefix "UT," followed by the associated 8-digit HUC, and ends in a 3-digit DWQ sequential number. Similarly, lake, reservoir, and pond AUs are identified by adding the prefix "UT-L-" to the 8-digit HUC, followed by a 3-digit sequential number.

Figure 1 provides an example of how DWQ uses these guidelines to delineate and identify AUs within a major watershed. The Weber River is delineated as a linear AU from its confluence with Chalk Creek upstream to the Wanship Dam and designated as UT16020101-017. South Fork Chalk Creek (UT16020101-011) in the Chalk Creek watershed is delineated by combining two 12-digit HUCs comprising the South Fork Chalk Creek sub-basin. The first AU (UT16020101-010) in the Chalk Creek watershed above Echo Reservoir is delineated using the confluence of the South Fork as the upstream endpoint. This necessitated splitting the 12-digit HUC into two AUs, one for Chalk Creek below the confluence with South Fork (UT16020101-010) and another AU for Chalk Creek above the South Fork confluence and below the Huff Creek confluence to form UT16020101-012. UT16020101-019 AU is an example of small tributary streams that could not be combined into a hydrological based AU. These are very small tributaries, and the Weber River is not reflective of their stream order or the habitat that they flow through. Echo Reservoir (UT-L-16020101-001) and Rockport Reservoir (UT-L-16020101-002) are examples of lake or reservoir AUs.

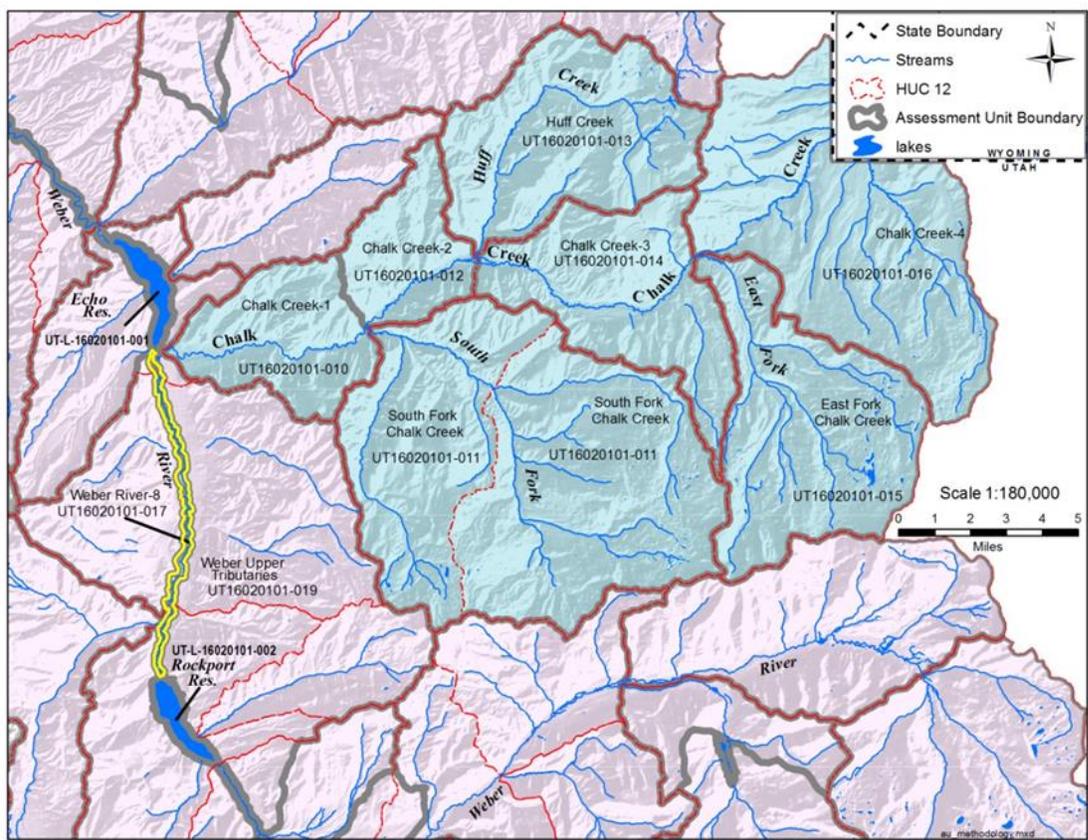


Figure 1. Utah Division of Water Quality assessment unit delineations.

**AU Stream Mileage Estimation for Flowing Surface Waters and Canals**

Flowing surface water assessments are summarized by stream mileage in each assessment category. Stream mileage within each AU is estimated using a streams GIS layer generated by the Utah Automated Geographic Reference Center (AGRC). This layer was derived from the high resolution (1:24,000 scale) National Hydrologic Dataset (NHD). Stream mileage within an AU is estimated as the sum of the lengths of all perennial and intermittent streams and canals identified in the site-specific numeric criteria in [UAC R317-2-14](#) or named in the list of waters with designated use classifications in [UAC R317-2-13](#). The NHD-based layer is only used to estimate stream mileage within an AU and is not used to define individual monitoring locations as perennial or intermittent or remove monitoring locations from the assessment process..

**WATERS WITHIN AND SHARED WITH OTHER STATES**

Though readily available data may exist from locations near Utah’s state boundaries, DWQ only assesses monitoring sites that are within the jurisdictional boundaries of the state for 303(d) purposes. Assessment units or sites on lands under tribal jurisdiction are not assessed in the IR. Assessed surface waters of the state (as defined in Table 4) that flow into Utah but originate outside of Utah’s borders will be assessed using DWQ monitoring locations within state boundaries. Lakes, reservoirs, and ponds that overlap with other state jurisdictions (e.g., Lake Powell, Bear Lake, and Flaming Gorge) will be assessed using the monitoring locations that fall within Utah state jurisdictional boundaries.

DWQ will work with neighboring states, as resources allow, on any impairments that fall close to jurisdictional boundaries by notifying the neighboring state of the impairments or exceedances and available data relevant to the impairment.

# Data Quality

## ***CREDIBLE DATA DEFINED***

All readily available data and information that are submitted to the [Utah's Integrated Report program \(Utah's IR program\)](#) or obtained during the IR's data compilation process must be of high quality to be considered for 303(d) assessments.

Utah's IR program defines credible data as a complete and validated data submission consisting of

- Water quality samples and field measurements (data) that are collected using appropriate quality assurance (QA) and quality control (QC) procedures, including proper documentation
- Environmental data that are representative of water quality conditions at the time of sampling
- Documented field sample collection, processing, and laboratory analyses that are documented and follow established protocols, procedures, and methods. Further information on proper adherence to these requirements is available upon request.

Utah's IR program relies on documentation from project planners, sample collectors, and laboratories to help ensure that data are of known quality and defensible. External entities are not obligated to collect data under the specifications of any of DWQ's or EPA's currently established quality assurance protocols to be considered credible, but all sources of data must meet the definition of credible data. DWQ will evaluate the credibility of data using the criteria and documentation described in the following sections.

Please note that the definition of credible data outlined in this document is specific to Utah's IR program and does not restrict other programs (e.g., water quality standards development, TMDLs, etc.) within DWQ from using data for other Division reporting analyses and actions. Data used for a Watershed Plan, for example, may not necessarily meet the credible data requirements for Utah's IR program but may meet the needs of a Watershed Plan.

## ***COMPONENTS FOR CREDIBLE DATA***

### **Quality Assurance Program Plan Guidance and Example**

Utah's IR program requires that all assessment-related decisions that use data are supported by a Quality Assurance Project Plan (QAPP). QAPPs *"integrate all technical and quality aspects of a project, including planning, implementation, and assessment."* *The purpose of a QAPP is to document planning results for environmental data operations and to provide a project-specific "blueprint" for obtaining the type and quality of environmental data needed for a specific decision or use. The QA Project Plan documents how quality assurance (QA) and quality control (QC) are applied to an environmental data operation to assure that the results obtained are of the type and quality needed and expected"* (EPA, 2002).

DWQ does not require entities to follow a specific QAPP. However, external entities should be prepared to share the QAPP they relied on for the data collection associated with a particular submission. External entities may choose to follow one of the example QAPPs below or develop a QAPP specific to their entity or sampling program(s).

#### **Example QAPPs**

- [Environmental Protection Agency's Quality Assurance Quality Program Guidance & Requirements](#). EPA's requirements and guidance documents for ensuring that all environmental data are of a known quality and

defensible. Utah's IR program encourages DWQ staff, cooperators, and all other parties interested in submitting high quality data to the IR program to review QA/R-5 and QA/G-5.

- [DWQ Quality Assurance Program Planning \(QAPP\)](#). DWQ's document outlining the minimum Quality Assurance and Quality Control (QA/QC) requirements for environmental data generated by DWQ and used by most of its cooperators.

### Sampling Analysis Plan Guidelines and Examples

Sampling Analysis Plans (SAPs) are the second type of documentation that Utah's IR program requires when compiling information for assessments and other programmatic decisions. SAPs *"are intended to assist organizations in documenting the procedural and analytical requirements for one-time, or time-limited, projects involving the collection of water, soil, sediment, or other samples taken to characterize areas of potential environmental contamination. It combines the basic elements of a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan"* (EPA, 2014).

DWQ does not require that entities follow a specific SAP. However, external entities should be prepared to share the SAP relied upon for data collection associated with a particular submission. External entities may choose to follow one of the example SAPs below or develop a SAP specific to their sampling program(s).

#### Example SAPs

- [EPA's Sampling Analysis Plan Guidance & Requirements](#).
- [DWQ's recommended Sampling Analysis Plan Requirements](#). These requirements are currently used by DWQ and its cooperators. This document contains information on what DWQ looks for in a SAP (see Appendix 2)

### Standard Operating Procedures Guidelines and Examples

Standard Operating Procedures (SOPs) are documented procedures that describe the routine operations of a monitoring program in full detail. Utah's IR program requires SOPs as part of data submission packages to ensure consistency and comparability across sampling techniques from disparate data sources.

DWQ does not require that entities follow a specific SOP. However, external entities should be prepared to share the SOPs relied upon for data collection associated with a particular submission. External entities may choose to follow the example SOPs below or develop SOPs specific to their sampling program(s).

#### Example SOPs

- [EPA's Guidance for Preparing Standard Operating Procedures \(G-6\)](#). EPA's guidance for developing and providing the necessary documentation when generating an SOP. DWQ recommends referring to EPA's guidance if not using DWQ's SOP.
- [DWQ Standard Operating Procedures](#). DWQ generates SOPs for any procedure that becomes routine, even when published methods are utilized. The use of SOPs ensures data comparability, defensibility, and accuracy, and reduces bias. DWQ has published the following final SOPs on its website:
  - a. Aquatic Benthic Macroinvertebrate Collection in Rivers and Stream
  - b. [Calibration, Maintenance, and Use of Multiparameter Water Quality Sondes](#)
  - c. Chain of Custody Samples
  - d. [Collection and Handling of Total Coliform and \*Escherichia coli\* \(\*E. coli\*\) Samples](#)
  - e. [Collection and Preparation of Fish Tissue for Analysis](#)
  - f. [Lake Water Sampling and Data Collection](#)
  - g. [Collection of Water Chemistry Samples in Streams](#)
  - h. [Collection and Filtering of Water Column and Benthic Chlorophyll a Samples](#)
  - i. [Phytoplankton Collection to Detect Harmful Algal Blooms](#)
  - j. Secchi Disk Depth Measurements

## k. Stream Flow Measurement

### Sampling Observations and Laboratory Comments

Utah's IR program requires documentation of field conditions that may affect data quality or laboratory comments on QA/QC issues encountered during analysis. Appendix 2 includes an example of sampling observations DWQ recommends documenting in the field for grab sample collections, and the credible data matrices included in Table 5 - Table 9 describe additional sampling and laboratory observations and comments required by Utah's IR program.

### Monitoring Location Information

DWQ must review all of the monitoring location information associated with datasets to assess waterbodies against the numeric criteria assigned in [UAC R317-2-14](#). This process involves validating the location's geospatial information in GIS, assigning beneficial uses to DWQ-validated locations, and merging monitoring locations and their associated data where locations are representative of the same waterbody or segment. Information that must be included with a monitoring location measurement:

- Monitoring Location ID (organization's unique identifier for the sample site)
- Waterbody type description
- Monitoring location, latitude/longitude measurements and associated metadata as defined on Utah's IR program's [Call for Data](#) webpages.

A monitoring location and its associated data will not be included in the assessment if DWQ's geospatial review of the monitoring location information finds insufficient or inaccurate information (e.g., it cannot be mapped or is improperly recorded by the sampler in the field).

### ***CREDIBLE DATA MATRICES***

DWQ will consider the scientific rigor of the sampling information and measurements associated with sites where beneficial uses can be assigned to a DWQ-validated monitoring location. DWQ uses a data-type-specific, credible-data matrix to assess the validity of the sampling and analytical protocols associated with a sample measurement. As noted in the credible-data matrices, each credible-data matrix considers the field and laboratory QA/QC protocols, sampling and laboratory methods, analytical detection or instrumentation limits, and field observations associated with a sample measurement. DWQ assigns a grade level (A–C) to the associated sample measurement(s) based on the level of information provided and the strength of the metadata associated with the sample measurement.

DWQ considers measurements that receive an A or B grade to be of high quality and will consider and use them to assign an EPA-derived assessment category to a waterbody (i.e., the IR's 305(b) and 303(d) assessments). Measurements that receive a C grade are considered to be of insufficient quality for assessment and 303(d) listing purposes. Details on the required data quality criteria for inclusion in the IR and use by Utah's IR program are included in Table 5.

Table 5. Data validation criteria for water quality field grab sample parameters.

Data Quality Grade	Quality Assurance	Essential Metadata <sup>1</sup>	Calibration Documentation	Field Documentation	Flow Data	Calibration: Water Temperature Methods*	Calibration: pH Methods*	Calibration: Dissolved Oxygen, Percent Saturation for Calibrated Meter*	Calibration: Dissolved Oxygen, Concentration Methods for Calibrated Meter*
<b>A</b>	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is included with the data submission.	Available for DWQ review if requested for all field parameters	Available for DWQ review if requested	Submitted or available for DWQ review if requested	Checked against <a href="#">NIST</a> A ≤ ± 0.1 °C R ≤ 0.01 °C	Calibrated pH Probe A ≤ ± 0.2 R ≤ 0.01	0-200 %Sat: A ≤ ± 1% R ≤ 0.1%	0-8 mg/L: A ≤ ± 0.01mg/L > 8mg/L: A ≤ ± 0.02 mg/L R ≤ 0.01
<b>B</b>	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is provided to DWQ upon request.	Available for DWQ review if requested, for field parameters	Unavailable	Not submitted or unavailable	A ≤ ± 0.5 °C R ≤ 0.05 °C	Calibrated pH Probe A ≤ ± 0.5 R ≤ 0.05	0-200 %Sat: A ≤ ± 2% R ≤ 0.2%	0-20 mg/L: A ≤ ± 0.1 mg/L R ≤ 0.1
<b>C</b>	QAPP, SAP, or SOP is unavailable Not Submitted	Essential metadata is missing from the data submission and is unavailable.	Unavailable	Unavailable	Not submitted or unavailable	A ≥ ± 0.5 °C R ≥ 0.05 °C OR not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data	Not a calibrated meter, missing, or rejected data

<sup>1</sup> Essential metadata elements are sample location (latitude/longitude), sample date and time, parameter name, result value and unit.  
\*Footnote: A = accuracy, R = range

Table 6. Data validation criteria for water quality high frequency dissolved oxygen data.

Data Quality Grade	Quality Assurance Quality Assurance Project Plan (QAPP)	Essential Metadata <sup>1</sup>	Calibration Documentation	Data QA/QC Information or Report	Field Documentation	Flow Data	Calibration: Dissolved Oxygen*, Percent Saturation for Calibrated Meter	Calibration: Dissolved Oxygen*, Concentration Methods for Calibrated Meter
<b>A</b>	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is included with the data submission.	Mandatory-calibration record(s) (e.g., field records of calibration and/or fouling)	Documentation describing the QA/QC process on the raw data	All pertinent deployment data (i.e., information necessary for interpreting data)	Submitted or available for DWQ review if requested	0-200%: A ≤ ± 1% R ≤ 0.1%	0-8 mg/L: A ≤ ± 0.01 mg/L > 8mg/L: A ≤ ± 0.02 mg/L R ≤ 0.01
<b>B</b>	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is provided to DWQ upon request.	Mandatory-calibration record(s) (e.g., field records of calibration and/or fouling)	Documentation describing the QA/QC process on the raw data	All pertinent deployment data (i.e., information necessary for interpreting data)	Not submitted or unavailable	0-200%: A ≤ ± 2% R ≤ 0.2%	0-20 mg/L: A ≤ ± 0.1 mg/L R ≤ 0.1
<b>C</b>	QAPP, SAP, or SOP is unavailable	Essential metadata is missing from the data submission and is unavailable.	Unavailable	Unavailable	Unavailable	Not submitted or unavailable	missing, or rejected data R ≤ 0.2%	R ≤ 0.1

<sup>1</sup> Essential metadata elements are sample location (latitude/longitude), sample date and time, parameter name, result value and unit.  
\*Footnote: A = accuracy, R = range  
Please note: Raw and QA/QC data records *must be* submitted to qualify for consideration in 303(d) assessments.

Table 7. Data validation criteria for water quality chemistry grab sample parameters.

Data Quality Grade	Quality Assurance Project Plan (QAPP)	Essential Metadata <sup>1</sup>	Laboratory Method	Detection Limits	Lab Certification	QC Data	Laboratory Comments	Field Documentation	Metals*	Organics*	Inorganics*
<b>A</b>	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is included with the data submission.	Standard Methods	Below applicable water quality standard	Utah Bureau of Laboratory Improvement certification, NELAC, or equivalent	Available for DWQ review if requested	Laboratory Comments Associated with Sample	Available for DWQ review if requested	Chronic: Aluminum submitted with Ca and Mg OR Lab Hardness and field pH; Cadmium, Chromium (III), Copper, Lead, Nickel, Silver, and Zinc submitted with Ca and Mg OR Lab Hardness	Pentachlorophenol submitted with field pH	Total Ammonia as N submitted with field pH or field Temperature
<b>B</b>	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is provided to DWQ upon request.	Standard Methods	Below applicable water quality standard	Documentation of laboratory procedures	Available for DWQ review if requested	Laboratory Comments Associated with Sample	Unavailable	Chronic: As above, but Aluminum submitted without Hardness or field pH will be assessed at 750 ug/l; As above, but samples submitted without Ca, Mg, or Lab Hardness **	Pentachlorophenol submitted without field pH	Total Ammonia as N submitted with field pH or field Temperature
<b>C</b>	QAPP, SAP, or SOP is unavailable	Essential metadata is missing from the data submission and is unavailable.	Missing or Non-Standard Methods	Above applicable water quality standards	No certification or laboratory documentation	Unavailable	No Laboratory Comments	Unavailable	Chronic: As above, but Aluminum without Hardness or field pH will not be assessed;	Pentachlorophenol submitted without field pH	Total Ammonia as N submitted with field pH or field Temperature

<sup>1</sup> Essential metadata elements are sample location (latitude/longitude), sample date and time, parameter name and fraction, parameter units, analytical method, result value or non-detect limitation, and laboratory name.

\*Footnote: Please also refer to UAC R317-2 to confirm that all the necessary data is submitted to DWQ so correction factors and equations may be fully calculated for 303(d) assessment purposes.

\*\*Footnote: Please refer to the 303(d) Assessment Methods for corrections to assessment due to missing values of hardness or pH.

Table 8. Data validation criteria for macroinvertebrate data.

Data Quality Grade	Quality Assurance Project Plan (QAPP)	Essential Metadata <sup>1</sup>	Field Documentation	Qualified taxonomy lab
A	EPA-approved Lab QAPP available for DWQ review if requested; SAP and SOP or equivalents available for DWQ review if requested	Essential metadata is provided to DWQ upon request.	Available for DWQ review if requested	Required
B	Lab QAPP or equivalent is available for DWQ review if requested; SAP and SOP or equivalents available for DWQ review if requested	Essential metadata is provided to DWQ upon request.	Unavailable	Required
C	QAPP, SAP, or SOP is unavailable	Essential metadata is missing from the data submission and is unavailable.	Unavailable	Unavailable
<sup>1</sup> Essential metadata elements are sample location (latitude/longitude), sample date and time, parameter name and fraction, analytical method, result value and unit, and laboratory name.				

Table 9. Data validation criteria for *Escherichia coli* (*E. coli*) data.

Data Quality Grade	Quality Assurance	Essential Metadata <sup>1</sup>	EPA Approved Method	Lab Documentation	QA/QC
A	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is provided to DWQ upon request.	IDEXX Colilert	Bench Sheet Present and Complete	Information on holding time, incubation*, and expiration dates provided.
B	QAPP, SAP(s), and SOP(s) or equivalents are available for DWQ review if requested	Essential metadata is provided to DWQ upon request.	IDEXX Colilert or EasyGel	Bench Sheet Present, incomplete, or not available	Not provided
C	QAPP, SAP, or SOP is unavailable	Essential metadata is missing from the data submission and is unavailable.	IDEXX Colilert or EasyGel	Unavailable	Not provided

<sup>1</sup> Essential metadata elements are sample location (latitude/longitude), sample date and time, parameter name and fraction, analytical method, result value and unit, and laboratory name.

\*Footnote: "incubation" refers to data and information that is recorded on DWQ's *E. coli* bench sheets and relates to time and temperature (i.e., time samples were placed in and taken out of the incubator and the temperature of the incubator when samples were placed in and taken out of it). For an example of how DWQ records this information, please refer to Appendix 3 of DWQ's [Standard Operating Procedure for Collection, Handling, and Quantification of \*Escherichia coli\* \(\*E. coli\*\) Samples](#).

# Data Submission Process

## ***TYPE OF DATA TO SUBMIT***

As referenced in [40 CFR 130.7\(b\)\(5\)](#), Utah’s IR program considers all existing and readily available data as defined in Table 3. Both quantitative and qualitative data may be used to evaluate whether physical, chemical, and biological characteristics of a waterbody are sufficient to support that waterbody’s designated uses. However, based on the type of data submitted to or obtained by DWQ during Utah’s IR program’s [Call for Data](#), some of these data may not be appropriate for assessments. DWQ considers several quantitative and qualitative types of data described in Table 10 for water quality assessments and analyses as recommended in EPA’s July 29, 2005, guidance (EPA, 2005).

**Table 10. Summary of data types considered by Utah’s IR program.**

Utah’s IR program Data Uses	Quantitative Data	Qualitative Data	Other
<b>305(b) and 303(d) Assessments (Grade A and B Data in credible data matrices)</b>	(1) Assessment parameters contained in Utah Water Quality Standards ( <a href="#">UAC R317-2</a> ) and Safe Drinking Water Act Standards (see <b>Error! Not a valid result for table.</b> ), (2) segment-specific ambient monitoring of analytical, physical, and/or biological conditions, (3) simple dilution calculations, and (4) human health/consumption closures, restrictions, and/or advisories	(1) Observed effects (e.g., fish kills), (2) complaints and comments from the public, and (3) human health/consumption closures, restrictions, and/or advisories	Landscape analysis (when applicable)
<b>Monitoring Planning and Training (Grade C and D Data in credible data matrices)</b>	See above	See above	(1) Landscape analysis (when applicable), (2) technical reports, (3) white papers, (4) articles from referred journals, and (5) other scientific publications

## ***PERIOD OF RECORD***

DWQ uses water years to define the period of record and uses the same definition of water years as the [U.S. Geologic Survey](#). USGS defines the water year as the 12-month period between October 1 and September 30 of the following year. For the 2022 IR, the period of record is October 1, 2014, to September 30, 2020, (water years 2015-2020).

Data and information from the IR’s period of record are considered to be most reflective of the current conditions of a waterbody. DWQ will analyze and assign EPA-derived assessment categories to the assessed waterbodies from this record period, provided the data meet the interpretive, sampling, and analytical considerations and protocols outlined in this document and on Utah’s IR program’s [Call for Data](#) webpages (see Table 1). Note that DWQ will retain all accepted data from the Combined 2018/2020 Integrated Report within the current period of record for assessment. DWQ will combine this dataset with additional data received through the Call for Data as well as any data collected between October 1, 2018, and September 30, 2020, and submitted to readily available data sources.

### Older Data and Information

DWQ will not consider data and other information older than the period of record in the current IR and 303(d) list unless the data are used to support a secondary review of an impairment determination. Instead, DWQ will encourage the data submitter to collect newer information and submit that data and information in future calls for data. The IR's period of record does not preclude DWQ from using older or longer-term datasets for programs other than assessments (e.g., water quality standards development, TMDLs, etc.).

### Newer Data and Information

Quantitative and qualitative data types that are considered in 303(d) assessments but are collected or represent conditions after the closing date specified in the above period of record will not be considered in the current reporting cycle. DWQ does not include these newer datasets because of the time required to compile data, perform data quality checks, format data from different sources, assess, review assessments, and generate the IR and 303(d) for public comment by April 1 of even-numbered years.

### ***DATA SUBMISSION TOOLS***

Data should be submitted in a form that is compatible with the Utah's IR program's existing data-management and QA capabilities. Please refer to Table 3 and the Utah's IR program's [Call for Data](#) webpages for more information on how to submit data for consideration in the IR.

# Data Preparation for Conventional and Toxic Assessments for All Waters

DWQ compiles all high quality credible data within the period of record of concern following the readily available and credible data reviews, and then standardizes, validates, and prepares the data for assessments. To assist reviews and increase transparency to reviewers, DWQ uses a series of database comments and flags rather than altering raw data and accompanying metadata. Though High Frequency Dissolved Oxygen (DO) and *E. coli* assessments are considered conventional assessments (see Table 11), these parameters have data preparation protocols that are unique to those datasets. Please refer to the High Frequency and *E. coli* assessment sections of this document for more details.

## ***RESULTS BELOW DETECTION LIMITS***

Environmental chemistry laboratories often report sample results as below their detection limit for a given analytical method. These limits are variously reported as minimum detection limit, minimum reporting limit, and/or minimum quantitation limit. DWQ screens and flags laboratory result values that are empty and have detection limits higher than the water quality criteria in [UAC R317-2-14](#). These flagged data records are not considered for the analysis. The reported result value or a value of 0.5 times the lowest reported detection limit for sample results below detection is applied for purposes of the assessment. However, if the detection limit is above the water quality standard, the data will not be used in the assessment.

## ***DUPLICATE AND REPLICATE RESULTS***

Datasets often contain duplicate and replicate sample results due to QA/QC procedures, reporting errors, or sampling design. In these cases, a single daily value is determined by accepting the highest result for parameters with not-to-exceed criteria in [UAC R317-2-14](#), or the lowest reported value for parameters with minimum criteria in [UAC R317-2-14](#). All data are retained in the assessment dataset and flagged as rejected because of replicate or duplicate values.

## ***INITIAL ASSESSMENT: MONITORING LOCATION SITE LEVEL***

DWQ determines attainment or nonattainment of numeric standards by assessing credible data at the monitoring location site level against the numeric criteria in [UAC R317-2-14](#). DWQ developed this protocol because individual assessments offer a more direct measure of the support or non-support of water quality standards in [UAC R317-2](#).

Multiple parameter assessments at an individual monitoring location and results from multiple monitoring locations within the same AU are summarized and combined using the procedures outlined in the Determination of Impairment: All Assessment Units section of this report.

# Assessments Specific to Flowing Surface Waters of the State and Canals

## CONVENTIONAL PARAMETER ASSESSMENTS

DWQ currently assesses five parameters within [UAC R317-2-14](#) as conventional parameters and assesses them against the beneficial-use specific criteria established in [UAC R317-2](#). Several waterbodies with conventional numeric criteria have site-specific standards articulated in self-explanatory footnotes within DWQ’s surface water standards ([UAC R317-2-14](#)). Site-specific standards that require further clarification for 303(d) assessment purposes are noted and explained in Table 11. Sites that do not meet water quality standards as described below are not supporting of beneficial uses for 303(d) assessment purposes.

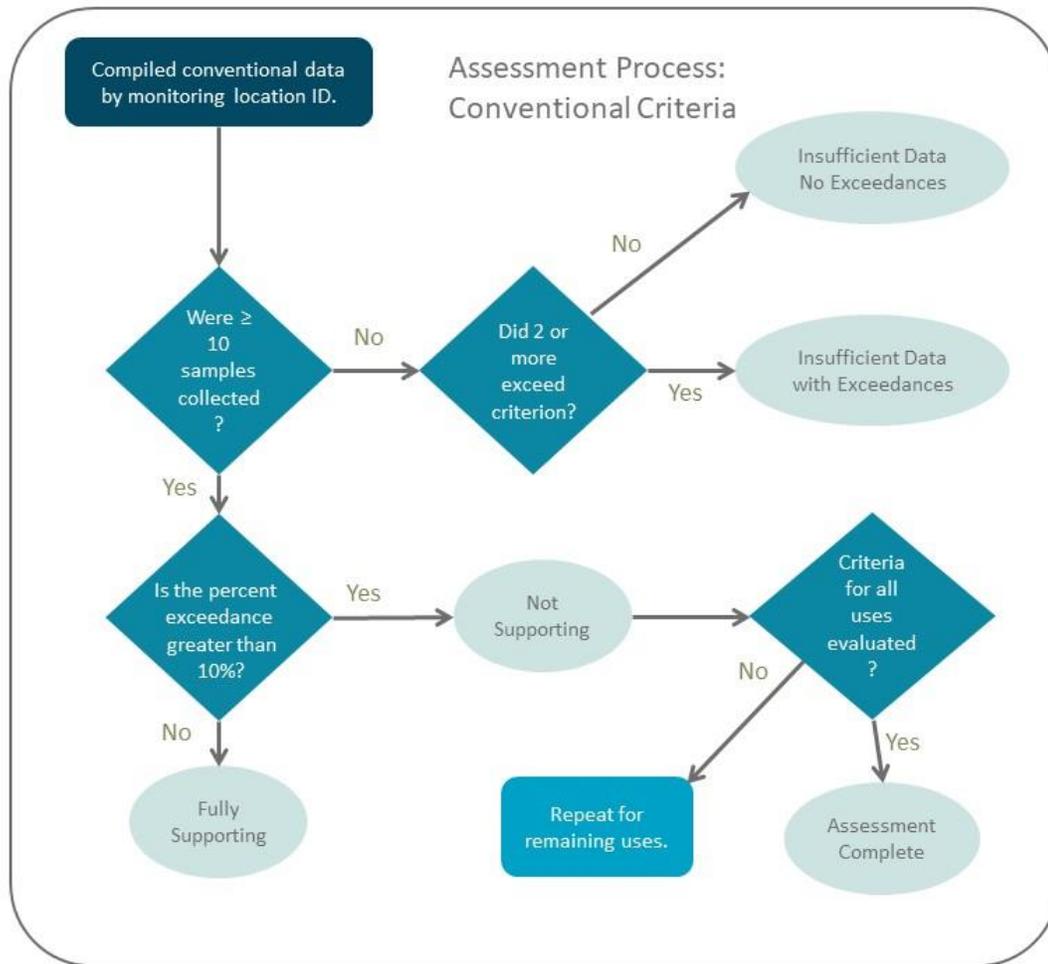
**Table 11. Conventional parameters and associated designated uses as identified for assessment purposes.**

Parameters	Designated Use	Notes
DO*	Aquatic life	DO measurements collected by instantaneous/ grab samples are assessed against the 30-day averages in <a href="#">UAC R317-2-14</a> and follow the assessment process in Figure 2 for flowing surface waters and the "Assessments Specific to Lakes, Reservoirs, and Ponds" section of the methods. DO measurements that are collected by high frequency data probes are assessed against the 30- and 7-day averages and minimums in <a href="#">UAC R317-2-14</a> and follow the assessment process in Figures 3-5. Note: for high frequency DO assessments, DWQ assumes early life stages are present for the 7-day and minimum. Some site-specific standards have been generated for assessment purposes.
Maximum temperature*	Aquatic life	Some site-specific standards are used for assessment purposes.
pH*	Domestic, Recreation, Aquatic life	Criteria are identical across uses.

Parameters	Designated Use	Notes
Total dissolved solids (TDS)**	Agriculture	<p>Many site-specific standards are used for assessment purposes. Clarification on how three site-specific standards are used for 303(d) purposes are provided below:</p> <p>(1) For South Fork Spring Creek from the confluence with Pelican Pond Slough Stream to U.S. Route 89, two seasonal assessments are not performed. Instead, each sample is compared to the monthly corrected criteria in the footnote in <a href="#">UAC R317-2</a>.</p> <p>(2) Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek. If TDS exceeds the site-specific standard, the site is not meeting site-specific criteria. If TDS is not exceeding, total sulfate is assessed.</p> <p>(3) Quitchupah Creek from the confluence with Ivie Creek to Utah State Route 10: If TDS exceeds the site-specific standard, it is not meeting site-specific criteria. If TDS is not exceeding, total sulfate is assessed.</p> <p>(4) Blue Creek and tributaries, Box Elder County, from Bear River Bay, Great Salt Lake to Blue Creek Reservoir. The only site to be assessed within this area is 4960740. (All other sites within this area description will not be assessed for TDS).</p> <p>Site-specific standard associated with sulfate for the following areas:</p> <p>(1) Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, the area does not meet water quality standards.</p> <p>(2) Quitchupah Creek from the confluence with Ivie Creek to Utah State Route 10: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, the area does not meet water quality standards.</p>
Sulfate**	Agriculture	<p>Site-specific standard associated with sulfate for the following areas:</p> <p>(1) Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, the area does not meet water quality standards.</p> <p>(2) Quitchupah Creek from the confluence with Ivie Creek to Utah State Route 10: When TDS is not exceeding site-specific criteria and total sulfate exceeds site-specific criteria, the area does not meet water quality standards.</p>
<p>*Footnote: Indicate that assessments are performed from field measurement only.  **Footnote: Indicate that assessments are performed from lab measurements only.</p>		

### Grab Sample Assessments

A minimum of 10 samples for conventional parameters are required to determine if a site is meeting or not meeting water quality standards (Figure 2). Where locations have sufficient sample sizes of 10 or more, an exceedance percentage is calculated for each applicable beneficial use by dividing the number of samples exceeding the numeric criterion by the total number of samples. If the calculated percentage is less than or equal to 10%, the site is supporting its beneficial use and the next beneficial use is assessed. If the calculated percentage is greater than 10%, the site is not supporting its beneficial use and the next beneficial use is assessed. In the case of waterbodies with site-specific standards for TDS and sulfate, both criteria must be met or the waterbody will be listed as not supporting its agricultural use.



**Figure 2. Overview of the assessment process for conventional parameters using grab sample data.**

### High Frequency Assessments for Dissolved Oxygen

#### Data Preparation

High frequency data are often screened and corrected to account for sensor drift, calibration shift, strange anomalous points, and battery issues before data analysis and interpretation begins. These data screens are particularly important for dissolved oxygen (DO) sensors because they are subject to bio-fouling, especially in nutrient-rich water where they have the higher potential to become covered in algal growth. When bio-fouling occurs, it results in erroneous logger measurements or sensor drift. DWQ will use corrected high frequency data as documented by the data submitter for assessments. DWQ will contact the data submitter for clarification and additional information if it determines additional corrections may be required.

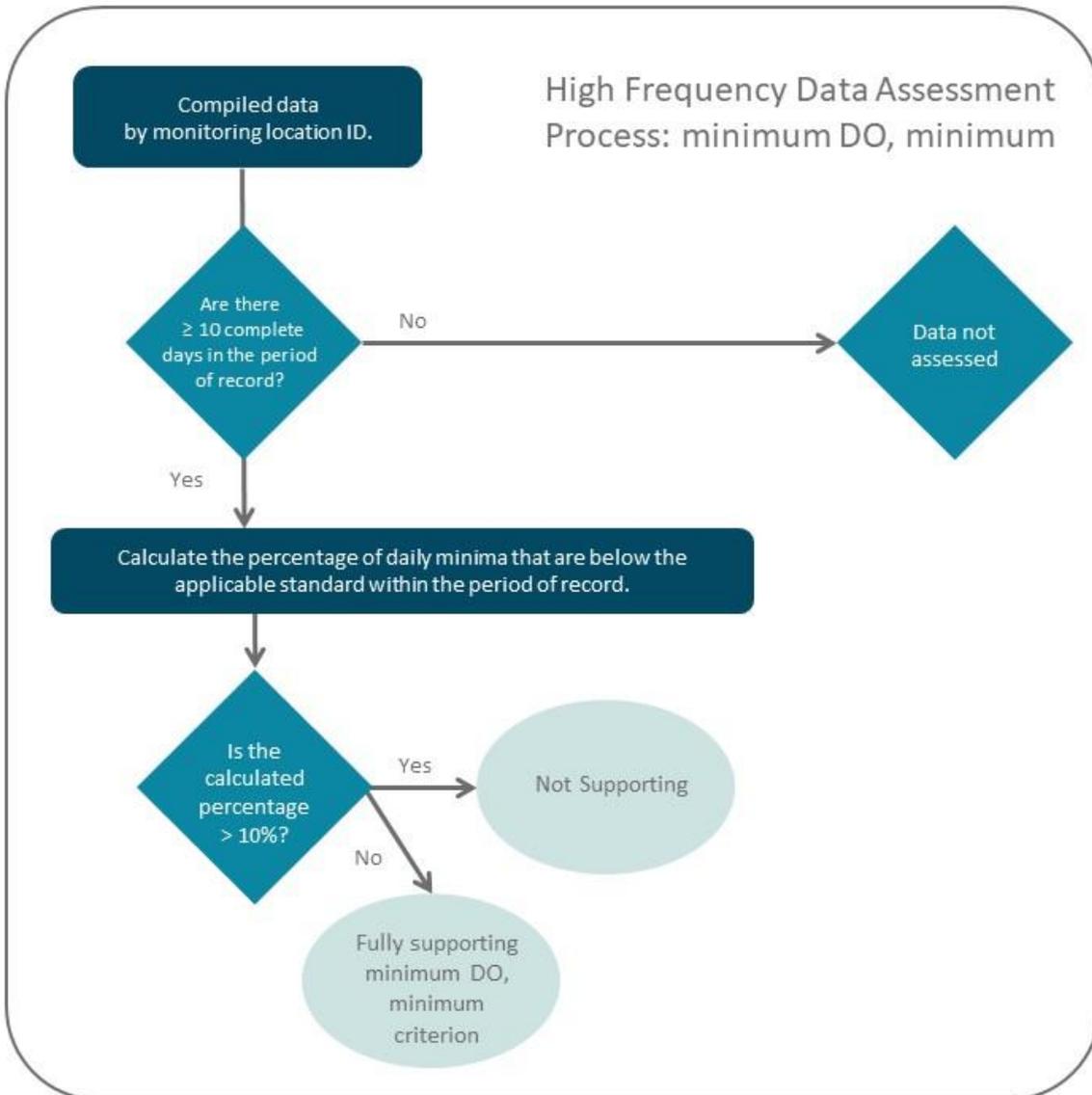
#### Data sufficiency

High frequency data must capture complete days to ensure daily minima are captured and daily averages can be accurately calculated. DWQ defines a complete day as a calendar day (i.e., 12:00 a.m. – 11:59 p.m.) in which at least one measurement is made in each hour. Incomplete days will not be included in the high frequency DO assessment.

**Assessment Process**

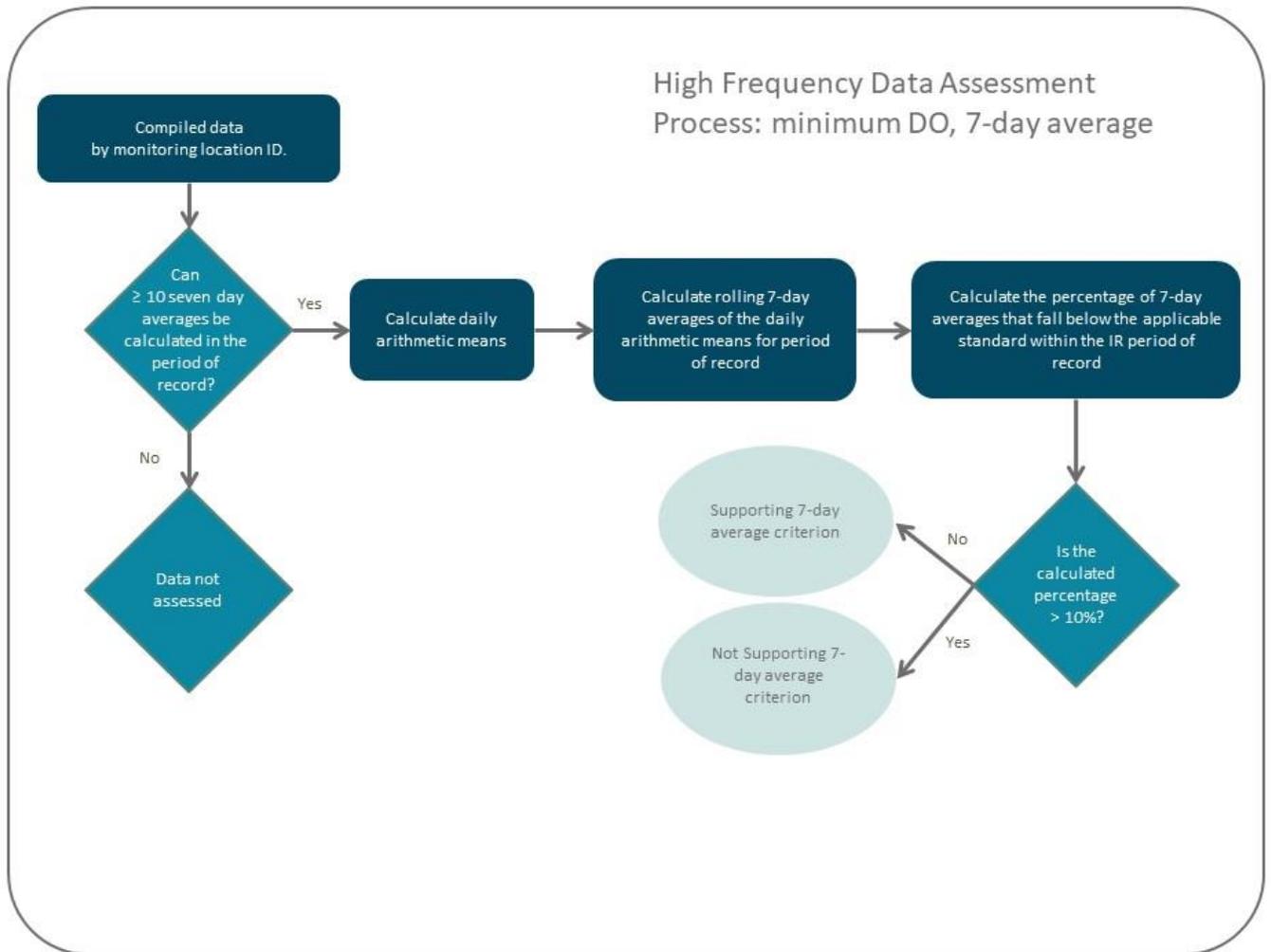
A daily minimum and daily average are calculated for each complete day in a dataset. Moving 7- and 30-day averages are then calculated from the daily averages for each 7- or 30-day period within the dataset. These values are then compared to the applicable daily minimum, 7-day average, and 30-day average criteria to determine use impairment or support.

A site does not meet the daily DO minimum criterion if the percentage of total daily minima that fall below the applicable standard is greater than 10% within the period of record (Figure 3).



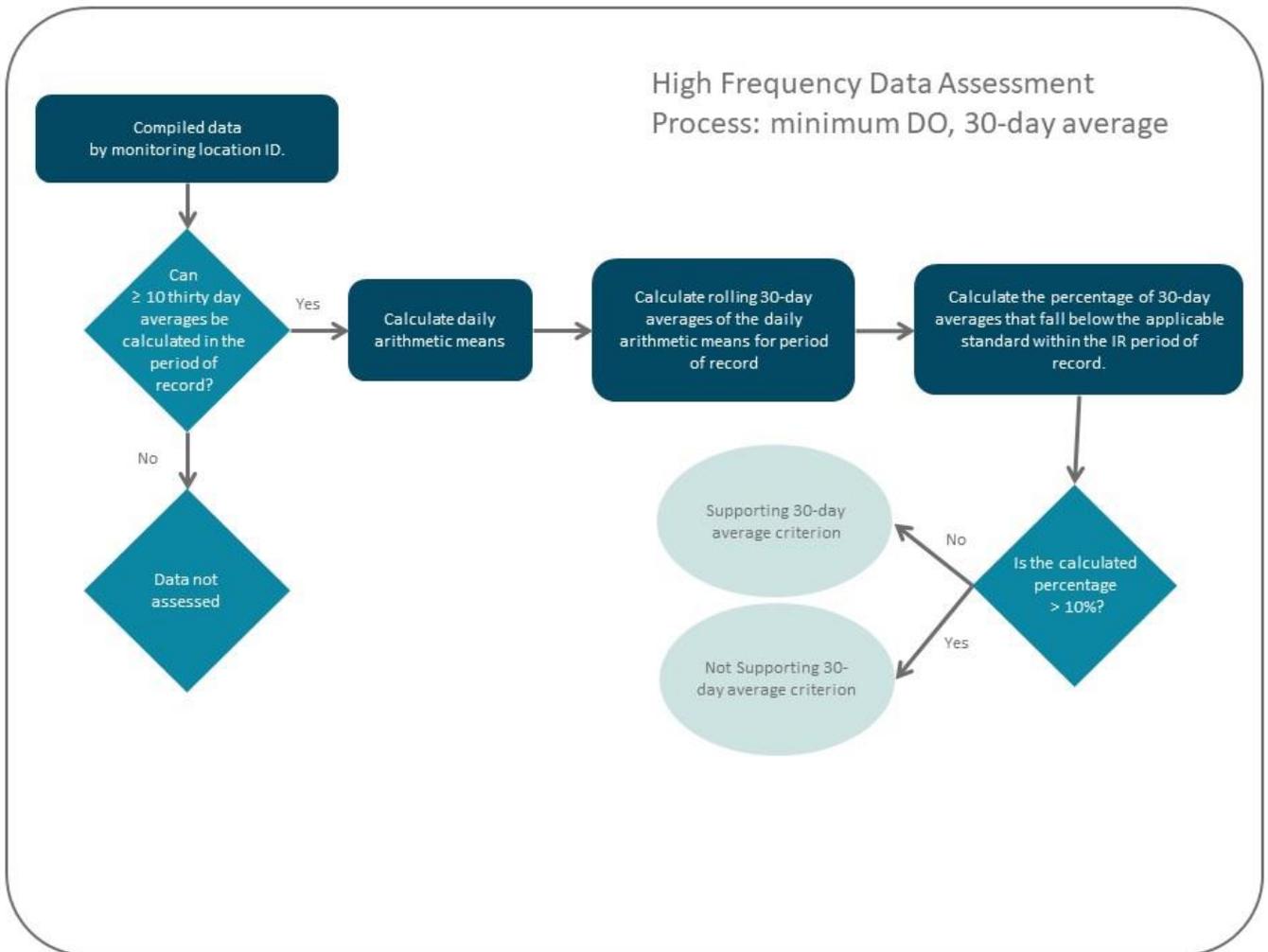
**Figure 3. Overview of the assessment process for the minimum dissolved oxygen, minimum, using high frequency data.**

A site does not meet the 7-day average criterion if the percentage of 7-day averages that fall below the applicable standard is greater than 10% within the period of record (Figure 4).



**Figure 4. Overview of the assessment process for the minimum dissolved oxygen, 7-day averages using high frequency data.**

A site does not meet the 30-day average criterion if the percentage of 30-day averages that fall below the applicable standard is greater than 10% within the period of record (Figure 5).



**Figure 5. Overview of the assessment process for the minimum dissolved oxygen, 30-day averages, using high frequency data.**

A site is considered not supporting if it is not meeting either of the daily minimum, 7-day average, or 30-day average criteria. A site is considered fully supporting if less than 10% violation is observed for all three criteria. This process (Figure 3 - Figure 5) is repeated until each beneficial use has been assessed.

### Analyzing Multiple DO Datasets at a Site

DWQ assesses grab and high frequency data independently during the initial assessment of DO at a site and reviews these assessments in the context of one another during the secondary review for determining impairment. These processes are discussed in greater detail in Determinations of Impairment: All Assessment Units.

### ***NUTRIENT ASSESSMENTS SPECIFIC TO HEADWATER STREAMS***

Utah's Numeric Nutrient Criteria (NNC) require consideration of both ambient nutrient concentrations and ecological response data for headwater streams, which are defined as streams where antidegradation category 1 or 2 protections have been established ([UAC R317-2-3](#)). Generally, this includes streams above United States Forest Service (USFS) boundaries—about 50% of all perennial streams statewide.

## Support of Aquatic Life Uses

The NNC applicable to aquatic life include two thresholds for total nitrogen (TN) and total phosphorus (TP) based on the arithmetic average of a minimum of four samples obtained during the growing season ([UAC R317-2-14.8](#)). Growing season is defined by the NNC as the period of algal growth through senescence. For assessment purposes, DWQ assumes that the growing season includes the months of June through September, although this may be lengthened where additional information demonstrates that a longer period of growth is warranted.

The arithmetic average of TN or TP, derived from four or more growing season samples, is used to place headwater streams into one of three enrichment tiers (Table 12). Lower criteria thresholds of 0.4 mg/L TN and 0.035 mg/L TP differentiate between low and moderate enrichment streams. Higher thresholds of 0.80 mg/L TN and 0.080 mg/L TP differentiate between moderate and high enrichment streams. The higher of TN or TP enrichment tiers is used to determine whether or not nutrient enrichment has degraded aquatic life uses at a site.

Any site where the growing season average of both TP and TN falls below the lower NNC thresholds (lowest enrichment tier) is considered to be supporting aquatic life uses with respect to nutrient enrichment (Figure 6).

At the other end of the enrichment gradient, any site where the average TN or TP concentration exceeds the upper NNC threshold (high enrichment tier) is categorized as threatened unless degradation is confirmed by an ecological response, in which case it is considered impaired (not supporting aquatic life uses). Threatened AUs are designated as category 5 due to highly enriched conditions, but the Division commits to more thoroughly evaluate the AU for adverse nutrient-related responses. If no adverse responses are identified within the AU watershed or downstream, the site will be considered to be supporting aquatic life uses and reclassified accordingly in subsequent IR reports.

Moderate enrichment streams, with average nutrient concentrations between the upper and lower thresholds, require additional measures of ecological condition to determine whether or not a headwater stream is attaining the NNC water quality standards. Nutrients can degrade aquatic life uses via mechanisms related to increased growth of plants/algae (autotrophs) and/or microbes/fungi (heterotrophs). In the case of plant/algae growth, two ecological responses are not-to-be-exceeded at any headwater stream: (1) a daily gross primary production (GPP) rate higher than 6 g O<sub>2</sub>/m<sup>2</sup>/day or (2) an aerial percent filamentous algae cover exceeding 1/3 of the stream bed. Adverse heterotrophic responses are addressed using ecosystem respiration (ER), which measures the net metabolic activities of all stream biota and is used to understand linkages among microbes/fungi, nutrients, and aquatic life uses. NNC establishes a not-to-be-exceeded rate for ER of 5 g O<sub>2</sub>/m<sup>2</sup>/day. Any site where TN or TP falls between the NNC thresholds is categorized as not supporting aquatic life uses if any of the three responses is also exceeded.

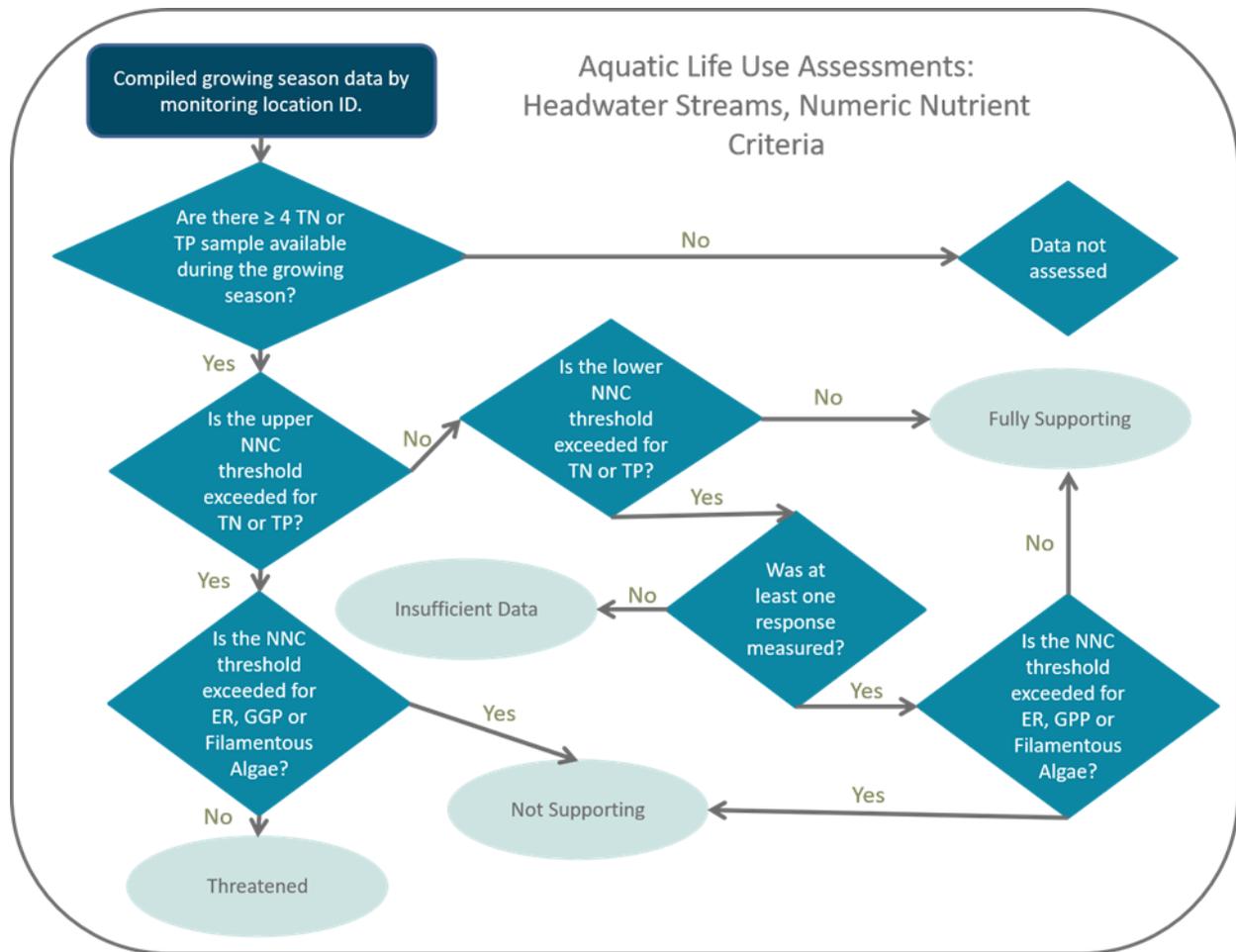


Figure 6. Overview of the assessment process to determine support of aquatic life uses based on nutrient enrichment in headwater streams.

## Support of Recreational Uses

Excessive nutrients can also degrade recreational uses. To protect these uses in headwater streams the NNC establish a not-to-be-exceeded benthic algae concentration of 125 mg/chlorophyll-a (chl-a)/m<sup>2</sup>, or the equivalent 49 g ash free dry mass (AFDM)/m<sup>2</sup> ([UAC R317-2-14.7](#)). A site where any reach-scale biomass value exceeds either threshold will be categorized as not supporting recreational uses (Figure 7).

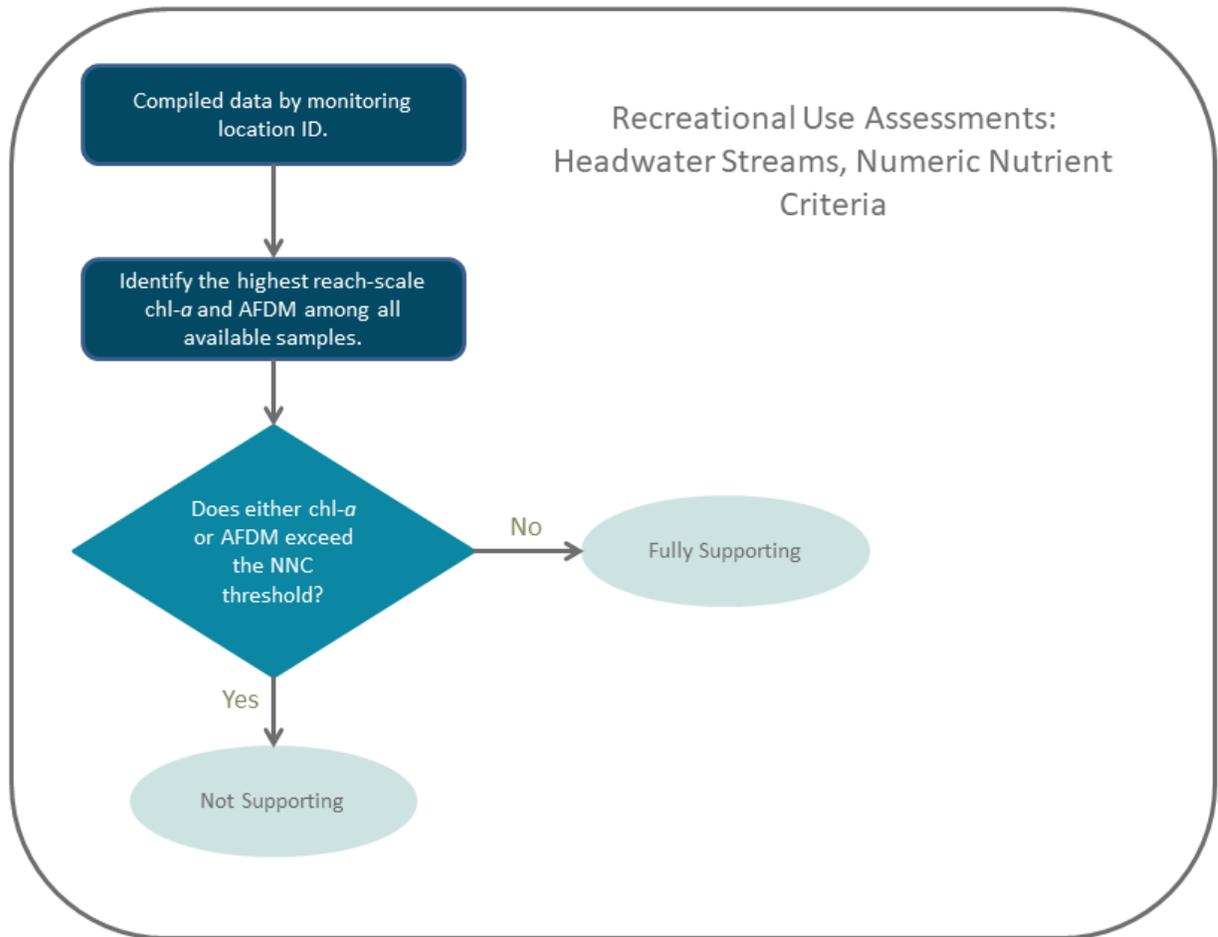


Figure 7. Overview of the assessment process to determine support of recreational life uses based on nutrient enrichment in headwater streams.

**Table 12. Numeric Nutrient Criteria and Associated Ecological Responses (Bioconfirmation Criteria) Proposed to Protect Aquatic Life Uses in Antidegradation Category 1 and 2 (UAC R317-2-12)<sup>f</sup> Headwater Perennial Streams.**

Nutrient Enrichment Level	Summertime Average Nutrients		Ecological Response	Assessment Notes
<b>Low</b>	TN < 0.40 <sup>a,b</sup>	TP < 0.035 <sup>a,b</sup>		Fully supporting biological uses if the average of ≥ 4 summertime samples is below the specified nutrient concentration of either TN and TP unless ecological responses specified for moderate enrichment streams are exceeded. Sites with fewer samples will not be assessed for nutrients.
<b>Moderate</b>	TN 0.40–0.80 <sup>a</sup>	TP 0.035–0.080 <sup>a</sup>	Plant/Algal Growth <sup>c</sup> < 1/3 or more filamentous algae cover <sup>d,e</sup> OR GPP <sup>c</sup> of < 6 g O <sub>2</sub> /m <sup>2</sup> /day OR Plant and Microbial Growth ER <sup>c</sup> < 5 g O <sub>2</sub> /m <sup>2</sup> /day	Headwater streams within this range of nutrient concentrations will be considered impaired (not supporting for nutrients) if any response exceeds defined thresholds.  Streams without response data will be listed as having insufficient data and prioritized for additional monitoring if either TN or TP falls within the specified range.
<b>High</b>	TN > 0.80 <sup>a,b</sup>	TP > 0.080 <sup>a,b</sup>		Streams over these thresholds will initially be placed on Utah’s Section 303(d) list as threatened.  Threatened streams will be further evaluated using additional data such as nutrient responses, biological assessments, or nutrient-related water quality criteria (e.g., pH and DO) both locally and in downstream waters.
<p>Notes: Criteria would be applicable unless more restrictive total maximum daily load (TMDL) targets have been established to ensure the attainment and maintenance of downstream waters. DO = dissolved oxygen, ER = ecosystem respiration, GPP = gross primary production, TN = total nitrogen in mg/L, and TP = total phosphorus in mg/L.</p> <p><sup>a</sup> Seasonal average of ≥ 4 samples collected during the summertime growing season (June 1–September 30) will not be exceeded. Sites will be assessed using the higher of TN and TP threshold classifications.</p> <p><sup>b</sup> Response data, when available, will be used to assess aquatic life use support or as evidence for additional site-specific investigations to confirm impairment or derive and promulgate a site-specific exception to these criteria.</p> <p><sup>c</sup> Daily whole stream metabolism obtained using open-channel methods. Daily values are not to be exceeded on any collection event.</p> <p><sup>d</sup> Filamentous algae cover means patches of filamentous algae &gt; 1 cm in length or mats &gt; 1 mm thick. Daily values are not to be exceeded at any time during the growing season (June 1–September 30).</p> <p><sup>e</sup> Quantitative estimates are based on reach-scale averages with at least three measures from different habitat units (i.e., riffle, run) made with quantitative visual estimation methods.</p> <p><sup>f</sup> Excluded waters identified in <a href="#">UAC R317-2-13.2</a> (c).</p>				

## ***NARRATIVE STANDARDS: BIOLOGICAL ASSESSMENTS***

Utah's beneficial uses for aquatic life require the protection of fish (cold water or warm water species) and the organisms on which they depend ([UAC R317-2-6.3](#)). DWQ historically assessed these beneficial uses using water chemistry sampling and associated standards that are protective of aquatic organisms. DWQ now uses an **empirically based model** that directly assesses support of aquatic life uses by quantifying the integrity of macroinvertebrate assemblages. Measuring biological communities directly has the advantage of integrating the combined effects of all pollutants, which allows a direct examination of how pollutants are interacting to affect the condition of a stream ecosystem (Karr,1981). Moreover, because aquatic macroinvertebrates spend most of their life in aqueous environments, they are capable of integrating the effects of stressors over time, providing a measure of past and transient conditions (Karr and Dudley,1981).

Biological assessments are often conducted by comparing the biological assemblage observed at a site with the expected biological assemblage. Ideally, these comparisons are made using historical data to measure changes to the current biological community. However, in most cases, historical data are not available. As a result, biological conditions representing least-human-caused disturbance are typically set using reference sites as benchmarks or controls. The biological integrity of sites can be evaluated by comparing the biological composition observed at a site against a subset of ecologically similar reference sites. Such comparisons are collectively referred to as biological assessments.

Reference sites in aquatic biological assessments are selected to represent the best available condition for waterbodies with similar ecological, physical, and geographical characteristics (Hughes et al.,1986; Suplee et al.,2005; [Western Center for Monitoring and Assessment of Freshwater Ecosystems](#) website). Conditions at reference sites selected for water quality programs vary regionally depending on adjacent historical land use. For example, reference sites in Utah mountains are generally more pristine than in valleys. As a result, there are more biological benchmarks in areas of the state that receive less-human-made disturbance than those with more disturbances.

A numeric index is a useful tool that quantifies the biological integrity, or biological beneficial use, of stream and river segments. Data obtained from biological collections are complex, with hundreds of species that vary spatially and temporally found throughout Utah. Similarly, the physical template on which biota depends also varies considerably across streams. A robust index of biological integrity should simultaneously account for naturally occurring physical and biological variability and summarize these conditions through a single, easily interpretable number (Hawkins, 2006; Hawkins et al. 2010).

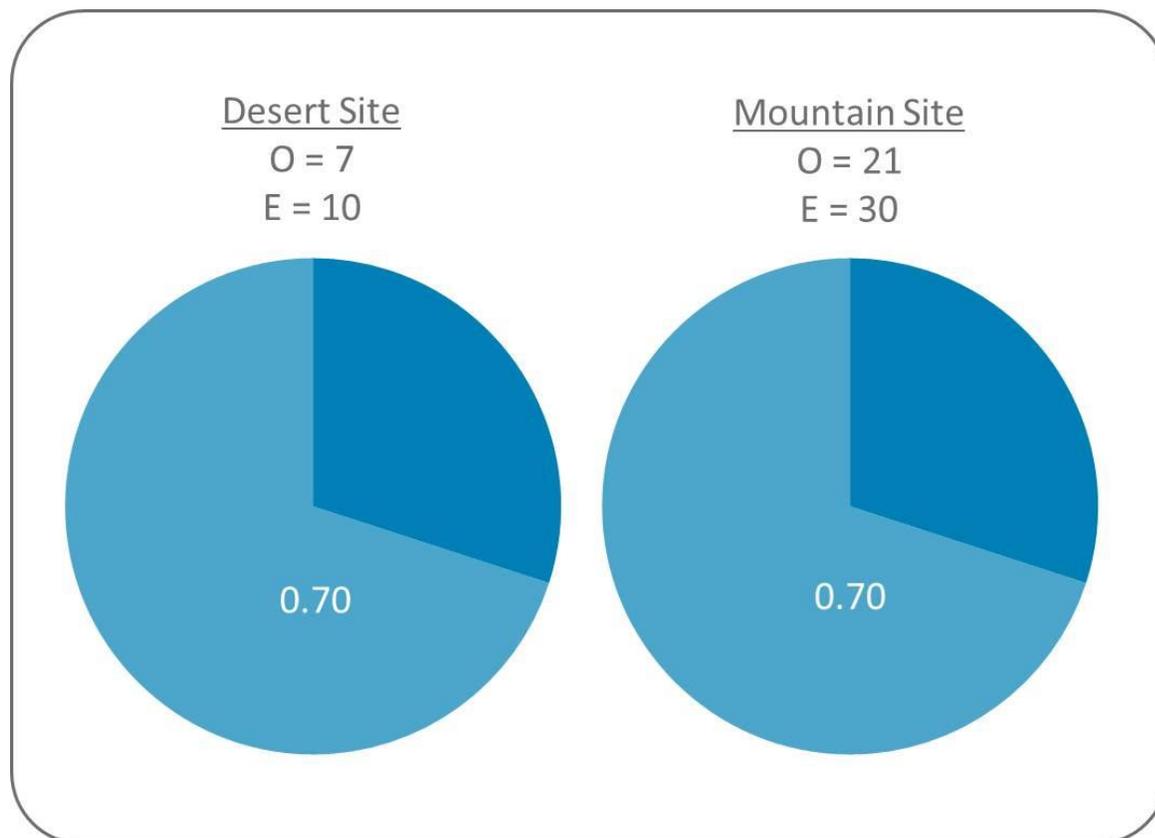
### **River Invertebrate Prediction and Classification System Models**

DWQ uses the River Invertebrate Prediction and Classification System (RIVPACS) model approach to quantify biological integrity (Wright, 1995). RIVPACS is a classification of freshwater sites based on macroinvertebrate fauna. It was first derived in 1977 and has subsequently been used in numerous biological assessment programs worldwide. In the early 1970s, scientists and water managers recognized a need to understand the links between the ecology of running waters and macroinvertebrate communities. A four-year project was initiated to create a biological classification of unpolluted running waters in Great Britain based on the macroinvertebrate fauna (Clarke et al.,1996; Furse et al.,1984; Moss et al.,1999; Wright,1995).

Over the past 30 years, equivalent RIVPACS models have been developed for aquatic ecosystems throughout the world, including Australia (Davies et al., 2000; Marchant and Hehir, 2002; Metzeling et al., 2002) and Indonesia (Sudaryanti et al., 2001). Scientists in the United States have developed RIVPACS models to assess the biological integrity of the country's aquatic habitats (Hawkins et al., 2000; Hawkins and Carlisle, 2001). Many western states recently adopted the RIVPACS model to determine beneficial uses of

aquatic life in the rivers of states such as Colorado (Paul et al., 2005), Montana (Feldman, 2006; Jessup et al., 2006), and Wyoming (Hargett et al., 2005).

RIVPACS models compare the list of taxa that are observed (O) at a site to the list of taxa expected (E) with the least-human-caused disturbance for a similar site to quantify biological condition. Predictions of E are obtained empirically from reference sites that together are assumed to encompass the range of ecological variability observed among streams in the region where the model was developed. In practice, these data are expressed as the ratio O/E, the index of biological integrity (Figure 8).



**Figure 8. A hypothetical example of O/E as a standardization of biological assessments.**

O/E has some very useful properties as an index of biological condition. First, it has an intuitive biological meaning. Species diversity is considered the ecological capital on which ecosystem processes depend; therefore, O/E can be easily interpreted by researchers, managers, policy-makers, and the public. Second, O/E is universally spatial, which allows direct and meaningful comparison throughout the state on a site-specific scale. This is particularly important for Utah, where streams vary considerably from high-altitude mountain environments to arid desert regions. Third, its derivation and interpretation do not require knowledge of stressors in the region as it is simply a biological measuring tool. Finally, the value of O/E provides a quantitative measure of biological condition.

### Model Construction and Performance

Construction of a RIVPACS model for Utah began in 2002 and involved the development and evaluation of dozens of models. Details of model development procedures can be found elsewhere (Clarke et al., 1996; Moss et al., 1999; Wright et al., 1993; Wright 1995). Additionally, specific detailed instructions can be viewed on the [Western Center for Monitoring and Assessment of Freshwater Ecosystems](#) website and the [EPA](#) website.

A brief summary is provided here to help the reader better understand Utah’s model results and subsequent assessments.

Predictions of expected “E” taxa are obtained empirically from reference site collections made throughout Utah. Reference sites represent the reference conditions in different biogeographical settings throughout the state. The initial list of candidate reference sites is independently ranked by different scientists familiar with the waterbodies. Only reference sites with a consensus representing best available conditions are used in model development. Subsequent reference sites are added using scores from reference-scoring metrics developed during site visits and averaged with independent rankings from field scientists.

Some of the calculations used to obtain the list of expected taxa are complex. A heuristic description of the steps involved in predicting “E” provides some context of the assessment methods. The first step in model development is to classify reference sites into groups of sites with similar taxonomic composition using a cluster analysis. Next, models are developed based on watershed descriptors such as climatic setting, soil characteristics, and stream size to generate equations that predict the probability of a new site falling within each group of reference sites. These equations account for environmental heterogeneity and ensure that when a new site is assessed, it is compared against ecologically similar reference sites. When a new site is assessed, predictions of group membership are then coupled to the distributions of taxa across groups of reference sites to estimate the probability of capturing (Pc) each taxon from the regional pool of all taxa found across all reference sites. E is then calculated as the sum of all taxa Pcs that had a greater than 50% chance of occurring at a site given the site’s specific environmental characteristics. Using a Pc limit set at greater than 50% typically results in models that are more sensitive and precise, which results in a better ability to detect biological stress (Hawkins et al., 2000; Simpson and Norris, 2000; Ostermiller and Hawkins, 2004; Hawkins, 2006; Van Sickle et al., 2007, Hawkins et al., 2015; Hawkins and Yuan, 2016; Mazor et al., 2016).

The accuracy and precision of RIVPACS models depend in part on the ability of the models to discriminate among groups of biologically similar reference sites. An extensive list of 74 GIS-based watershed descriptors is evaluated for potential predictor variables in models that predict the probability of membership within biological groups for sites not used in model construction. Site-specific, GIS-based predictor variables, such as soils, meteorology, and geography, instead of field-derived descriptors, are evaluated for a couple of reasons. First, GIS-based descriptors are unlikely to be influenced by human disturbance and are therefore unlikely to bias estimates of expected conditions (Hawkins, 2004). Second, these predictors are easily obtained for any location on a site-specific basis. This allows inclusion of additional macroinvertebrate samples collected by others. Various subsets of potential predictors are evaluated in an iterative, analytical process that explores different combinations of predictors to explain the biological variability among reference sites. The current RIVPACS model used by DWQ includes 15 variables that resulted in the most precisely predictive model (Table 13).

**Table 13. Final predictor variables used in model construction.**

<b>General Category</b>	<b>Description</b>
<b>Geography</b>	Mean watershed elevation (meters) from National Elevation Dataset
<b>Geography</b>	Minimum watershed elevation (meters) from National Elevation Dataset
<b>Geography</b>	Watershed area in square kilometers
<b>Geography</b>	Latitude of the sample location.
<b>Climate</b>	Watershed average of the mean day of year (1–365) of the first freeze derived from the PRISM data
<b>Climate</b>	Watershed average of the annual mean of the predicted mean monthly precipitation (millimeters) derived from the PRISM data

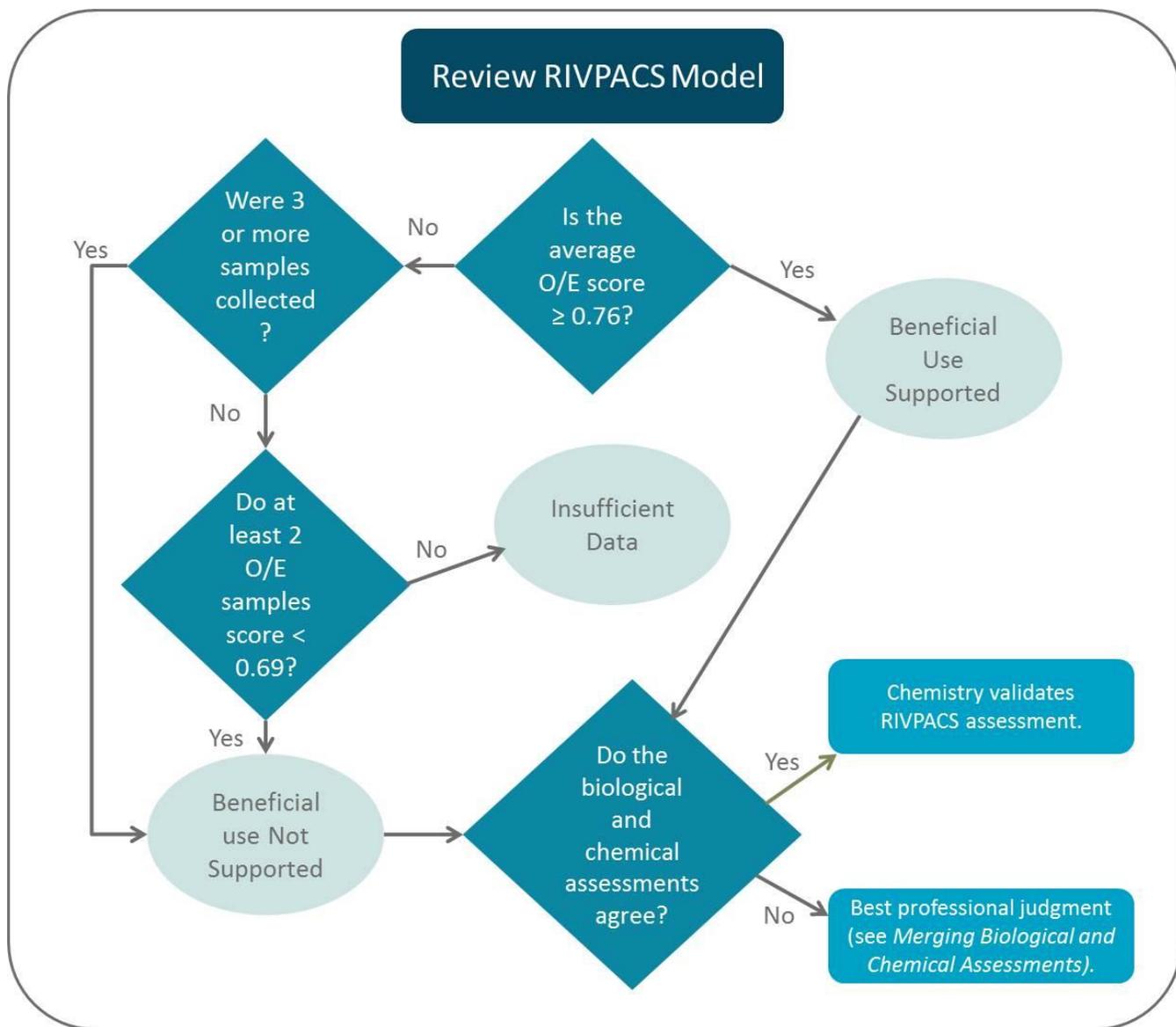
General Category	Description
Climate	Watershed average of the annual maximum of the predicted mean monthly precipitation (millimeters) derived from the PRISM data
Climate	Watershed average of the annual mean of the predicted mean monthly air temperature derived from PRISM data
Climate	Average of the annual mean of the predicted maximum monthly air temperature at the sample location derived from PRISM data
Climate	Watershed average of the annual mean of the predicted maximum monthly air temperature derived from PRISM data
Climate	Watershed average of the annual mean of the predicted minimum monthly air temperature derived from PRISM data
Climate	Watershed average of the annual mean of the predicted mean monthly relative humidity derived from PRISM data
Climate	Average of the annual mean of the predicted mean monthly air temperature at the sample location derived from PRISM data
Climate	Watershed maximum of mean 1961–1990 annual number of wet days
Vegetation	Watershed maximum of mean 2000–2009 annual enhanced vegetation index

The RIVPACS model used for the current assessments was reconstructed to accommodate broader spatial and temporal data. Models used earlier were limited to samples from streams ranging from second to fifth order and were collected during a fall window of September–November. The updated model accepts data collected from first- to eighth-plus-order rivers and streams with no limitations on season of collection. In addition, new predictor variables were tested, and new and updated reference site data were included. However, the taxon levels required adjustment to include data collected from agencies using different taxonomic laboratories. This resulted in a coarser resolution of taxonomy. However, the resulting model was capable of scoring nearly 1,800 samples collected across the state by various agencies.

The updated model is nearly as accurate and precise as previous models. If the model was perfectly accurate and precise, the O/E score for all reference sites would equal 1.00. Instead, reference O/E values are typically spread in a roughly normal distribution centered on 1.00 (Wright, 1995). Model precision is often expressed as the standard deviation (SD) of reference O/E values, with lower SDs indicating higher model precision. The RIVPACS model used for the current IR assessments has an SD of 0.19, which is within the range of “accepted” water quality models. The precision was likely affected by the coarser resolution of taxonomy and the inclusion of a few large river sites as reference. The average reference O/E score for the current model is 1.00, which means that the model has high precision calculating O/E values. The accuracy of the model was evaluated by examining the distribution of reference O/E scores across environmental settings and determining that reference O/E values are not biased by stream size, elevation, or ecoregion.

### Assessing Biological Use Support

DWQ does not have numeric biological criteria. However, DWQ has narrative biological criteria ([UAC R317-2-7.3](#)) that specify how quantitative model outputs are used to guide assessments. A systematic procedure to make the narrative assessments as rigorous as possible was devised to use the RIVPACS model O/E values to determine aquatic life beneficial use support (Figure 9). The goal of this assessment process is to characterize each AU as fully supporting or not supporting aquatic life beneficial uses.



**Figure 9. Decision tree for making biological assessment decisions.**

Utah currently assesses watersheds based on established AUs. Although many AUs contain a single biological monitoring location, some AUs contain multiple sites. In such instances, DWQ staff examines available data to determine if multiple sites in an AU score similarly. When comparisons suggest that sites in one AU are ecologically similar, O/E scores from all sites in an AU are averaged for assessment purposes, provided that conclusions of biological condition are similar. If O/E scores differ appreciably among multiple sites in an AU, DWQ will investigate possible explanations for such discrepancies (see the Assessment Unit Re-segmentation discussion for more information on that process). Additionally, if only one site is sampled in an AU, it is examined to determine whether it is an appropriate representation of the AU.

To translate the O/E values into assessment categories, it is necessary to devise thresholds, or O/E scores that indicate whether or not a site is meeting biological beneficial uses (Table 14). The 10th and 5th percentiles of reference sites were used for these assessments. Essentially, the data used for the current assessment calculate the threshold based on 5th percentile at 0.69, whereas the 10th percentile is 0.76. These thresholds will provide the bounds according to sample strength. The data will be averaged across six

years since the most recent year of available data. Multiple years are preferred for assessments because O/E scores can vary from year to year and assessments are based on average conditions. Assessments based on the average condition of three or more samples reduce the probability of making an error of biological beneficial-use support as a result of an unusual sampling event (e.g., following a flash flood, or a sample that was preserved improperly).

**Table 14. Beneficial use support determination for O/E values obtained from different sample sizes.**

Sample Size	O/E Threshold	Use Determination	Comments
≥ 1 sample collected over 6 years	Mean O/E score ≥ 0.76	Fully Supporting	Threshold based on 10th percentile of reference sites
≥ 3 samples collected over 6 years	Mean O/E score < 0.76	Not Supporting	Threshold based on 10th percentile of reference sites
< 3 samples	Mean O/E score ≥ 0.69–≤ 0.76	Insufficient Data	Lower threshold based on 5th percentile of reference sites
< 3 samples	2 O/E scores < 0.69	Not Supporting	Threshold based on 5th percentile of reference sites
< 3 samples	< 2 O/E scores < 0.69	Insufficient Data	Threshold based on 5th percentile of reference sites

AUs not meeting biological thresholds will be assessed as not supporting. Assessments of more than three samples with average O/E scores of greater than or equal to 0.76 have a low probability of being misclassified as nonsupport. Alternatively, assessments with fewer than three samples with an average O/E score of less than 0.69 have a 5% probability of being misclassified as nonsupport. To ensure that one sample was not incorrectly misapplied, at least two samples with a score of 0.69 or less will be required to consider an AU not meeting the aquatic life use. Assessments with fewer than three samples that have a mean O/E score of greater than or equal to 0.69 and less than 0.76 will be placed in Category 3 (insufficient data and information with exceedances), which indicates that there are insufficient data to make an assessment. All sites listed as Category 3 with exceedances will be given a high priority for future biological monitoring.

# Assessments Specific to Lakes, Reservoirs, and Ponds

## **ASSESSMENT OVERVIEW**

Lakes, reservoirs, and ponds are classified by basin in [UAC R317-2-13.12](#), with the accompanying tables listing their designated beneficial uses. Waterbodies not specifically listed are assigned beneficial uses by default to the classification(s) of the tributary stream(s). Numeric water quality criteria for both toxic and conventional parameters are assigned for each designated use in [UAC R317-2-14](#). Deeper lakes naturally stratify thermally, which affects how conventional water quality parameters are assessed ([UAC R317-2-14](#)), so each waterbody is evaluated for thermal stratification and assessed appropriately.

Utah lake and reservoir assessments are divided into two tiers:

### **Tier I**

The Tier I assessment is the preliminary determination of beneficial use support for recreational use (Class 2), aquatic life (Class 3), and agricultural (Class 4), classes based on conventional parameters such as DO, temperature, and pH, toxic parameters, and *E. coli*. When Tier I data are not available, DWQ may rely on Tier II data to make an initial assessment. The waterbody will be classified as mixed or stratified based on the depth profile information when considering aquatic life use support within this tier. If it is a stratified waterbody, the evaluation of conventional parameters will follow the protocol designed to evaluate the sufficiency of aquatic life habitat. If the waterbody is mixed, it will follow the assessment protocol that evaluates the entire depth profile.

### **Tier II**

The Tier II assessment looks further into specific weight of evidence criteria (trophic state index [TSI], fish kills, and algal composition) through secondary reviews. The Tier I preliminary support status may be modified through evaluation of the TSI, water quality related fish kills, and the composition and abundance of cyanobacteria, also known as harmful algal blooms. The Tier II evaluation could adjust the preliminary support-status ranking if at least two of the three criteria indicate a different support status.

## **TIER I ASSESSMENT**

### **Drinking Water Use Support**

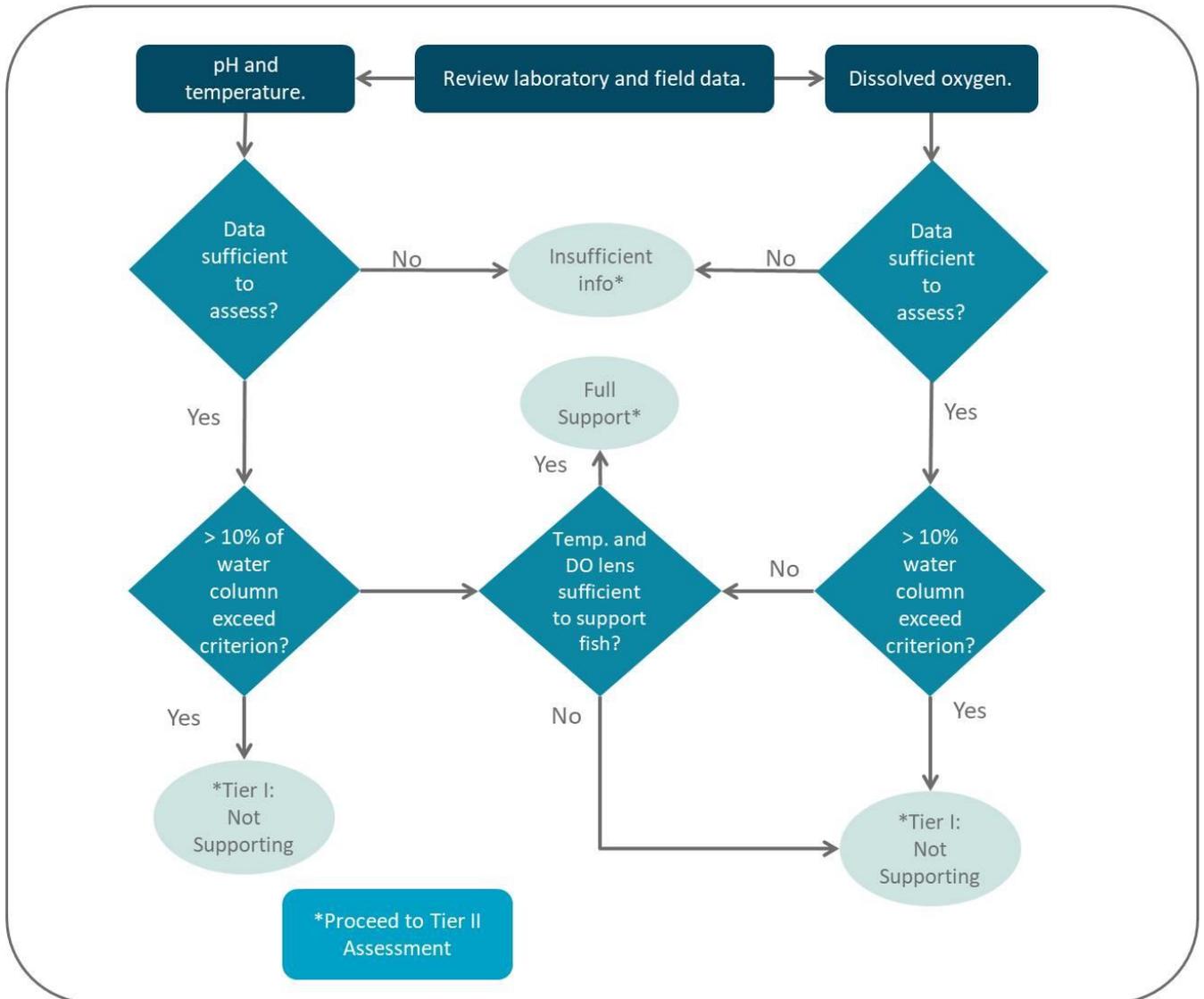
Drinking water use support is assessed through evaluations of pH, toxics, *E. coli*, and harmful algal blooms (HABs). Please review the Toxics Parameter Assessments for All Waters, *Escherichia Coli* Assessment for All Waters, and Harmful Algal Blooms (HAB) assessment sections for further information regarding drinking water use assessments for toxics, *E. coli*, and HABs. The evaluation process of pH is the same as the requirements for aquatic life uses described below.

### **Recreational Use Support**

Recreational use support is assessed through evaluation of pH, *E. coli*, and HABs. The pH evaluation is the same as the requirements for aquatic life uses described below. Please review the *Escherichia Coli* Assessment for All Waters and HAB assessment sections for further information regarding recreational use assessments for *E. coli* and HABs.

## Aquatic Life Use Support

Lake monitoring routinely involves collecting pH, temperature, and DO measurements at approximately one-meter intervals throughout the water column from the surface to the lake bottom. (Note: the measurement interval may be modified in the field depending on waterbody depth). These water column measurements are compared against Utah water quality standards to assess beneficial use support (Figure 10). A separate process is used to determine whether sufficient habitat is available for aquatic life for waterbodies that are thermally stratified (Figure 11).



**Figure 10. Process using conventional (nontoxic) parameters to assess lakes that are mixed.**

### *pH, All Lakes and Reservoirs*

#### *Beneficial Use Supported*

The beneficial use is supported if the number of violations are less than or equal to 10% of the measurements (see Figure 11, Panel A).

#### *Beneficial Use Not Supported*

The beneficial use is not supported if greater than 10% of the measurements (minimum of two discrete measures outside thresholds) violate the pH criterion (Figure 11, Panel B).

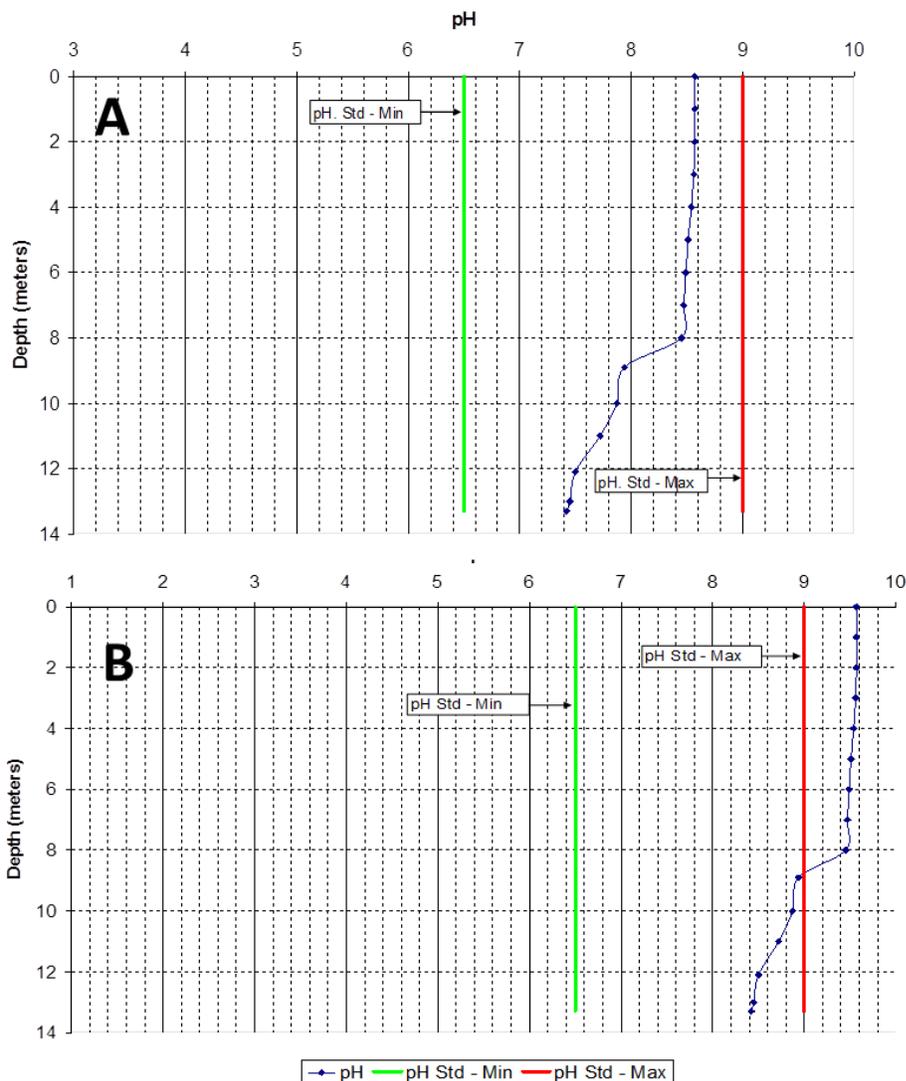


Figure 11. Plots of pH measurements (blue dots) against lake depth for a waterbody meeting (Panel A) and violating (Panel B) the pH water quality standards.

#### Temperature and Dissolved Oxygen, Mixed Lakes and Reservoirs

##### Temperature

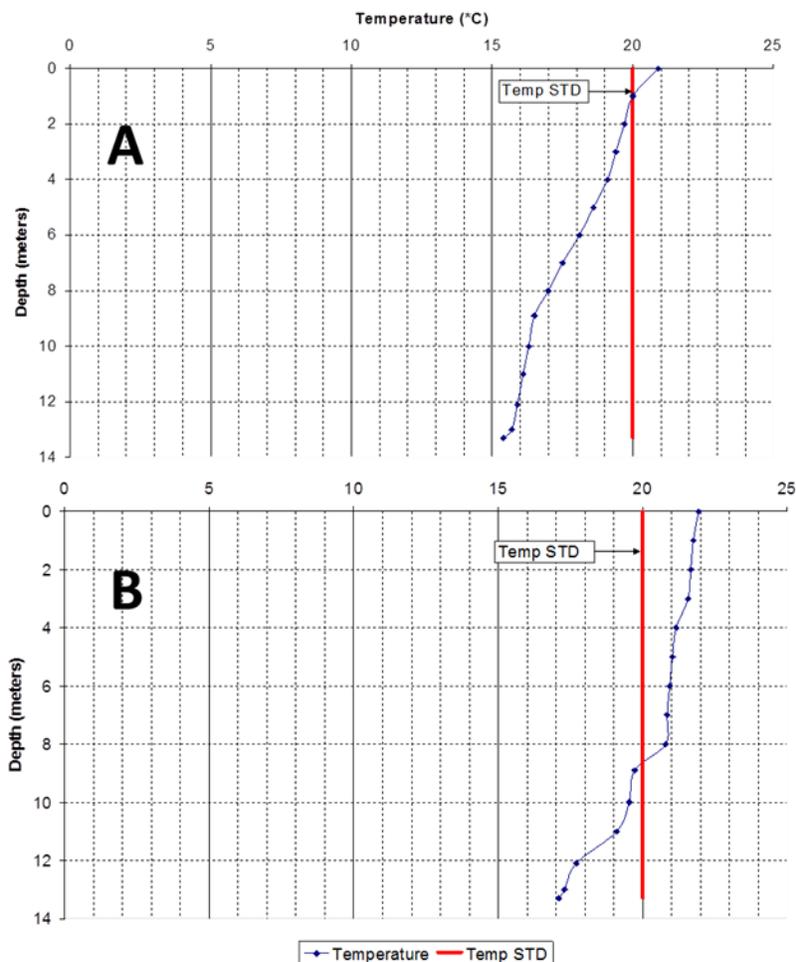
The criteria used to assess the beneficial use support are based on profile data. If the temperature criterion is exceeded in more than 10% of the measurements, with a minimum of two discrete measures exceeding criteria from any individual sampling event, the site is considered to be not supporting of aquatic life uses.

##### *Beneficial Use Fully Supported*

The beneficial use is supported if the number of violations is less than or equal to 10% of the measurements (see Figure 12, Panel A).

##### *Beneficial Use Not Supported*

The beneficial use is not supported if more than 10% of the measurements violate the temperature standard (see Figure 12, Panel B).



**Figure 12. Plots of temperature measurements (blue dots) against lake depth for two sites to provide an example of assessment procedures. Note: The red line illustrates a temperature criterion of 20 degrees Celsius: Class 3A beneficial use. Panel A (top) illustrates a site supporting the beneficial use because less than 10% of the temperature measures are greater than the criterion, whereas Panel B (bottom) illustrates a site not supporting the beneficial use because greater than 10% of the temperature measures exceed the criterion.**

### Dissolved Oxygen

The DO assessment uses data gathered from profiles. The DO assessment uses the minimum criteria of 4.0 mg/L for Class 3A waters and 3.0 mg/L for Class 3B and 3C waters ([UAC R317-2-14](#), Table 2.14.2). State standards account for anoxic or low DO conditions that may exist in the bottoms of deep waterbodies ([UAC R317-2-14](#)). For that reason, DO assessments for stratified lakes and reservoirs follow the stratified lakes and reservoirs assessment methods below.

#### *Beneficial Use Supported*

The beneficial use is supported if at least 90% of the oxygen measurements are greater than the standard.

#### *Beneficial Use Not Supported*

The beneficial use is not supported if greater than 10% of the oxygen measurements are below the DO standard during any single sampling event.

### Stratified Lakes and Reservoirs

#### Temperature and Dissolved Oxygen: Aquatic Life Use Assessment

When sample locations demonstrate stratification, a separate assessment technique for temperature and DO is used to ensure that sufficient habitat for aquatic life exists. Habitat is considered sufficient if at least three continuous meters of the water column are meeting the criteria for both temperature and DO. The rationale for a conclusion of beneficial use support based on the existence of adequate habitat follows the decision diagram (Figure 13). Figure 14 provides an example of supporting and not supporting beneficial uses based on the DO and temperature data above the thermocline.

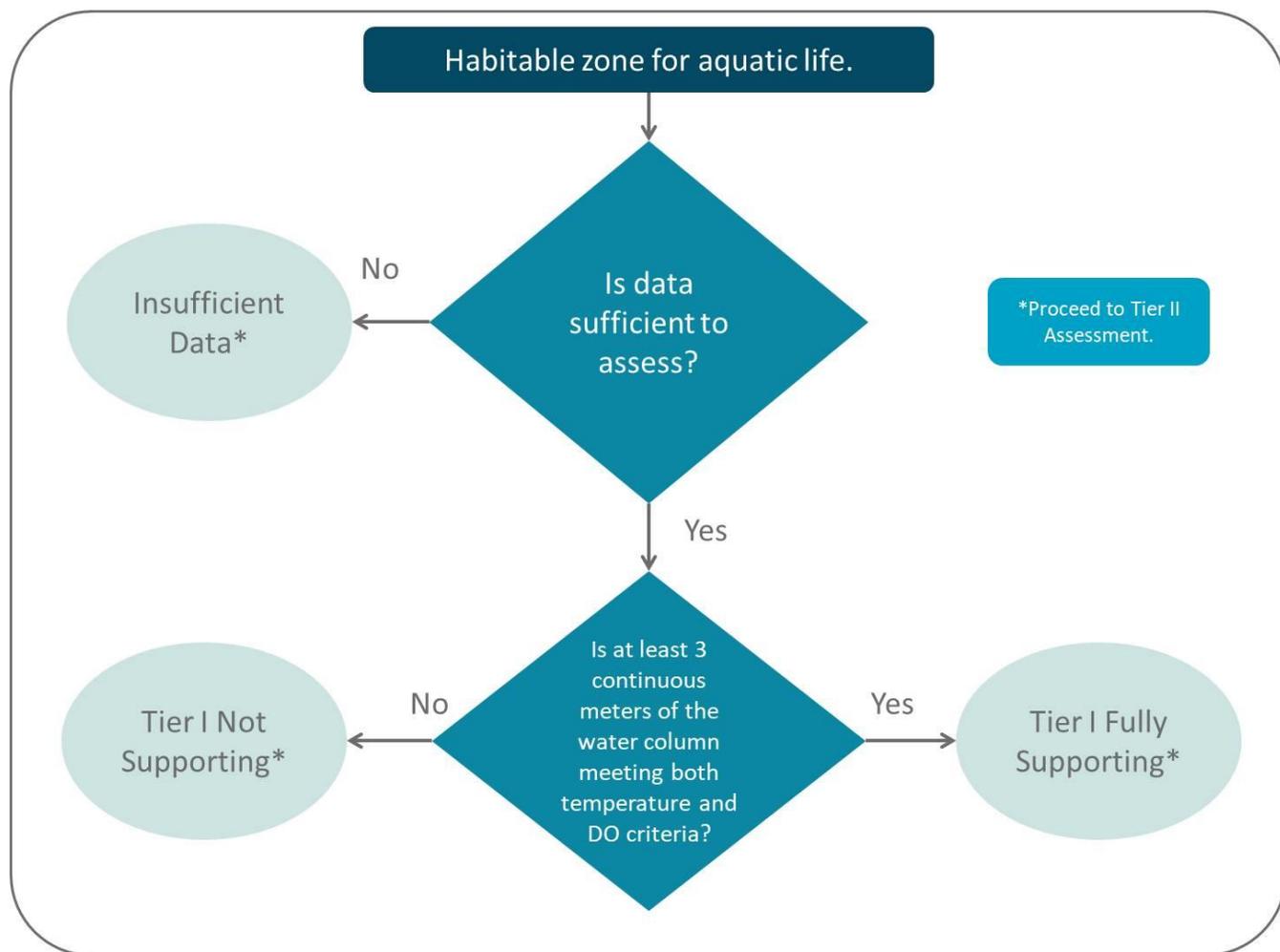


Figure 13. Beneficial use support based on the existence of adequate habitat.

#### *Beneficial Use Supported*

The beneficial use is supported if there is sufficient habitat, defined as three continuous meters of the water column meeting the criteria for both temperature and DO.

#### *Beneficial Use Not Supported*

The beneficial use is not supported if there is insufficient habitat for aquatic life based on the DO and temperature profile.

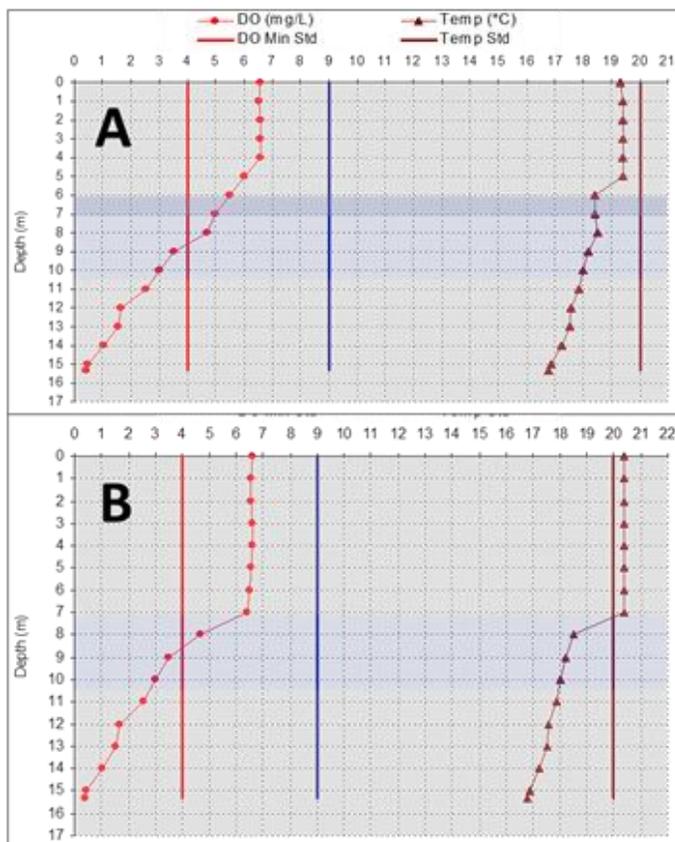


Figure 14. Concept of the habitable zone where both DO and temperature are suitable for aquatic life. The site depicted on the top (Panel A) would be considered supporting because the lens where both temperature and DO provide sufficient habitat is greater than three continuous meters ( $\geq 3$  m). Conversely, the site on the bottom (Panel B) is not supporting aquatic life uses because although there are regions in the water column where dissolved oxygen and temperature criteria are met separately, the region of overlap in the water column for both temperature and dissolved oxygen criteria (approximately 8 meters depth) is less than three meters.

#### Total Dissolved Solids: Agricultural Use Support

The following rules are used to determine whether a lake is supporting its agricultural beneficial use (Figure 15):

##### *Beneficial Use Supported*

The beneficial use is supported if the standard is exceeded in 10% or fewer of TDS samples.

##### *Beneficial Use Not Supported*

The beneficial use is not supported if the TDS standard is exceeded in more than 10% of TDS samples.

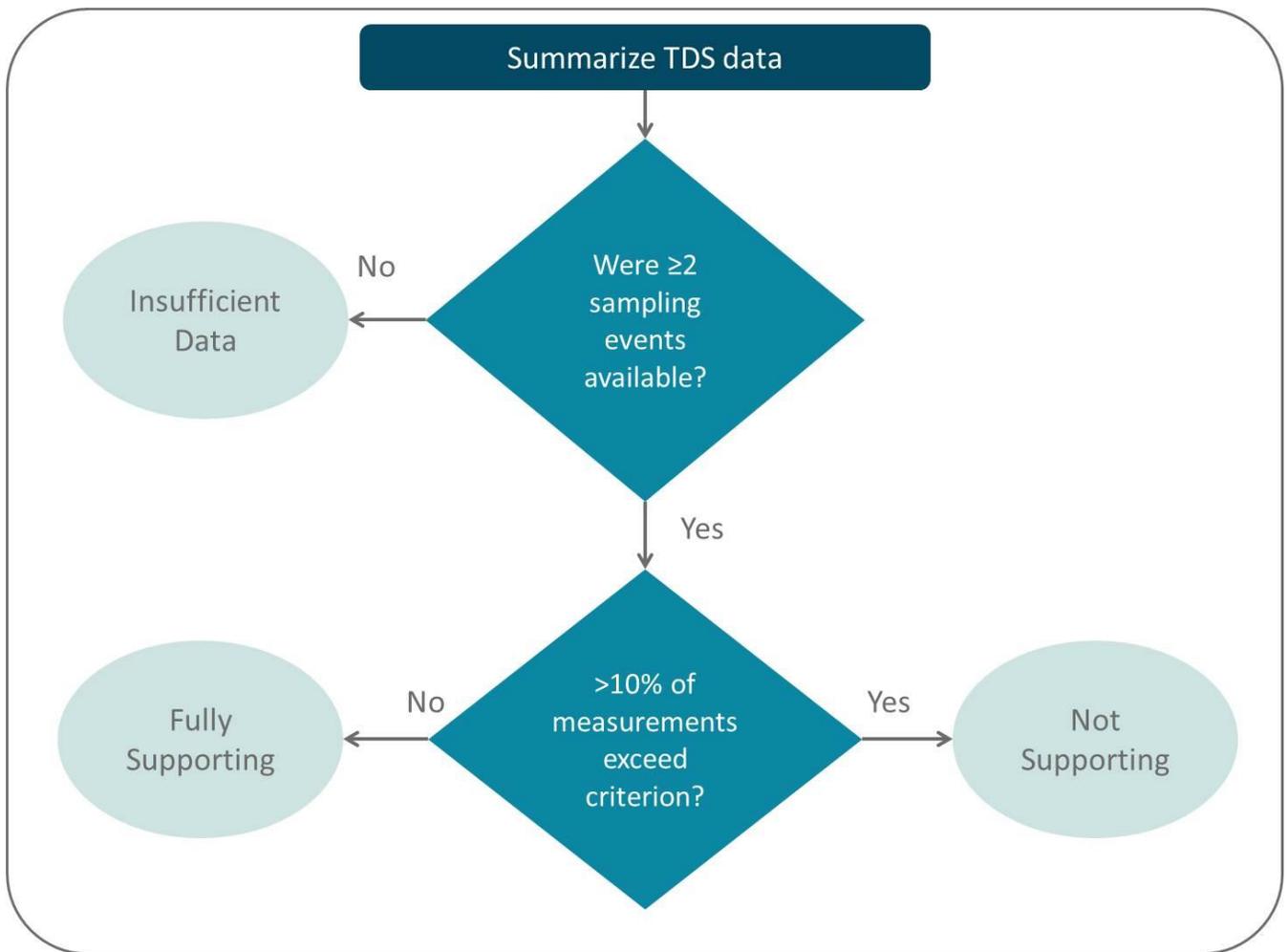


Figure 15. Assessment process to determine support of the agricultural beneficial use with TDS data.

## ***TIER II ASSESSMENT***

### **Weight of Evidence Criteria**

The weight of evidence criteria allows DWQ to use key lines of evidence for assessing a waterbody's beneficial use support, including evaluations of Utah's narrative standard.

The weight of evidence evaluation consists of three components:

- Increasing trophic state index (TSI) trend over the long term (approximately 10 years) or a TSI-Chl-a greater than 50 (see Carlson's Trophic State Index section below for more information)
- The observation of water quality based fish kills (see the Narrative Standards for All Waters for more information) or winter DO measures not meeting the criterion when measured
- Evaluation of phytoplankton community

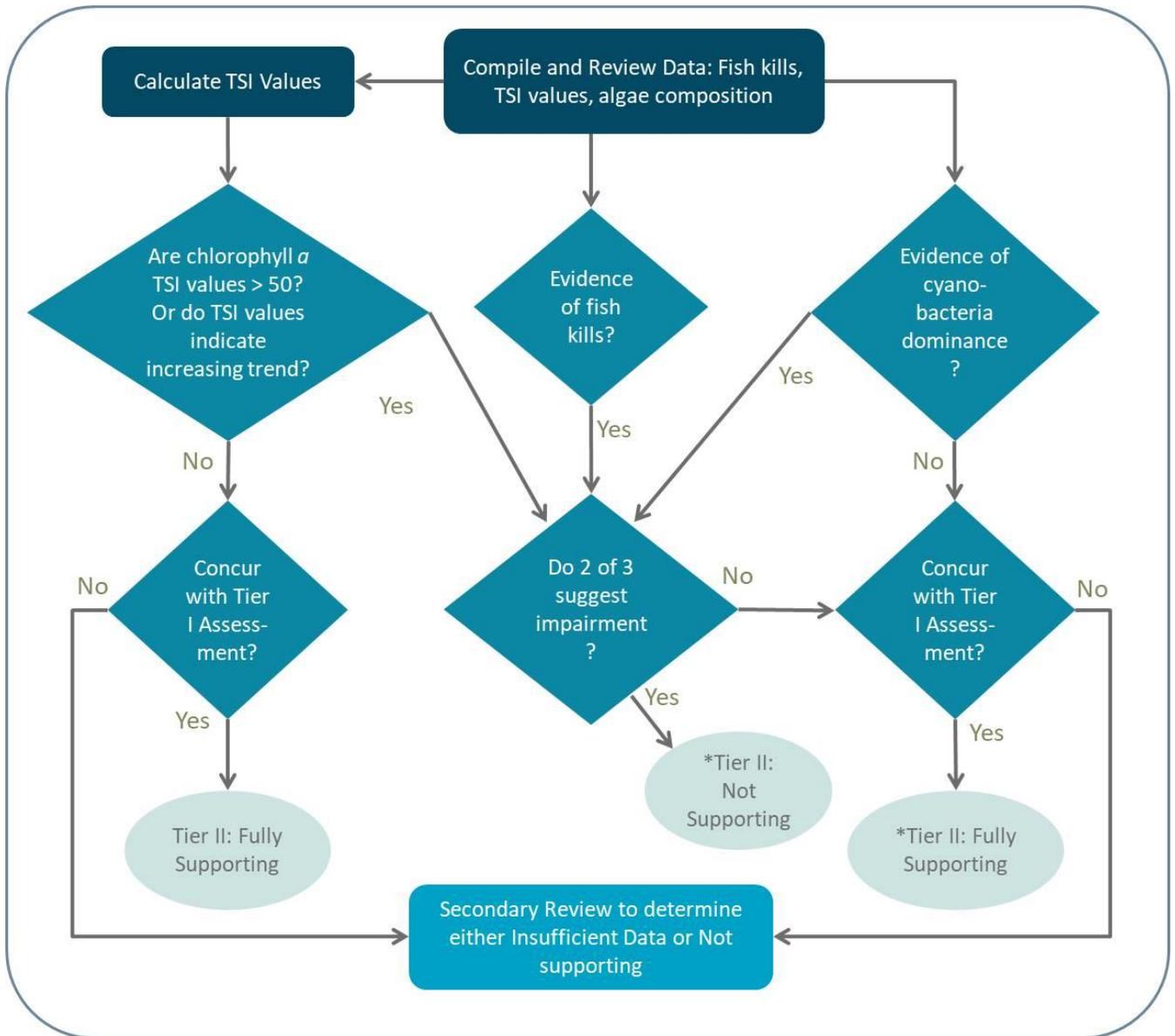


Figure 16. Tier II assessment process for lakes, reservoirs, and ponds.

### Carlson's Trophic State Index

The Carlson's TSI is calculated using Secchi disk transparency, total phosphorus, and chlorophyll a. TSI value ranges from 0 to about 100, with increasing values indicating a more eutrophic condition. TSIs are calculated independently for each indicator (i.e., Secchi disk, chlorophyll a, and total phosphorus) and are not averaged. Chlorophyll a (TSI-Chl-a) is generally considered the most reliable indicator of trophic status, followed by Secchi disk (TSI-SDD), and total phosphorus (TSI-TP) (Carlson, 1977).

Carlson's TSI estimate for chlorophyll a is calculated using the following equation:

- Trophic status based on Chlorophyll a (TSI-Chl-a):  $TSI-Chl-a = 9.81 \ln (Chl-a) + 30.60$ , where Chl-a = chlorophyll a concentrations in  $\mu\text{g/L}$ .

## Phytoplankton Community

DWQ routinely collects phytoplankton to evaluate the composition and relative abundance of algae and cyanobacteria. These data are used to identify waterbodies potentially undergoing cultural eutrophication that may negatively impact beneficial uses. Phytoplankton data are used in the Tier II assessment process because they may reflect nutrient availability and nutrient ratios. The observation that a waterbody has a diverse assemblage of diatoms or green algae relative to cyanobacteria or other potentially harmful taxa is used as a line of evidence that the waterbody is supporting its designated uses. In contrast, a phytoplankton assemblage dominated by cyanobacteria may be indicative of eutrophication, an increased potential for harmful algal blooms, and a loss of aquatic biodiversity.

## ***GREAT SALT LAKE***

The Great Salt Lake (GSL) is assigned its own beneficial use class (Class 5) and is further divided into five subclasses (5A–5E) that represent the four main bays (Gilbert, Gunnison, Bear River, and Farmington) and transitional waters ([UAC R317-2-6](#)). The only numeric water quality criterion currently applicable to GSL is a selenium bird-egg tissue criterion for Gilbert Bay (Class 5A). The beneficial uses of GSL are protected and assessed by Utah’s narrative water quality standard ([UAC R317-2-7.2](#)) in addition to this criterion. [The Great Salt Lake Water Quality Strategy](#) outlines the process for monitoring and criteria development for GSL.

### Gilbert Bay Bird-Egg Tissue Assessment

Bird eggs are collected annually during each nesting season from representative locations within the Gilbert Bay AU or adjacent transitional wetlands ([UAC R317-2-6.5](#)). Selenium concentrations from eggs collected each year are assessed against the criterion in [UAC R317-2-14](#). Gilbert Bay’s beneficial use will be identified as impaired if the geometric mean of selenium concentrations from five or more eggs collected in any year exceeds the 12.5 mg/kg criterion. If the geometric mean of selenium concentrations from five or more eggs collected in any year exceeds 9.8 mg/kg dry weight, DWQ will identify Gilbert Bay’s beneficial use as threatened and initiate preliminary TMDL studies to evaluate selenium loading sources. If Gilbert Bay is identified as impaired for selenium, five consecutive nesting seasons meeting selenium criteria will be considered sufficient for delisting the impairment.

The Gilbert Bay selenium criterion also includes thresholds below 9.8 mg/kg that trigger management actions (Table 15). DWQ evaluates egg concentrations against these thresholds to inform management decisions, but these thresholds are not used for use attainment determinations in the IR.

Eggs are also collected as part of discharge monitoring programs for certain dischargers to GSL. Eggs collected as a part of these programs are specifically intended to characterize discharge outfall conditions and are therefore not relevant to assessing more general GSL conditions. Eggs collected under these programs are only used for evaluating discharge permits and are not used in 303(d) assessment of the GSL AUs.

**Table 15. Selenium trigger levels and DWQ responses (UAC R317-2-14.2(14)).**

Se concentration (mg/kg dry weight)	DWQ Response
< 5.0	Routine monitoring with sufficient intensity to determine if selenium concentrations within the Great Salt Lake ecosystem are increasing
5.0	Increased monitoring to address data gaps, loadings, and areas of uncertainty identified from Great Salt Lake selenium studies
6.4	Initiation of a Level II Antidegradation Review (ADR) by the State for all discharge permit renewals or new discharge permits to Great Salt Lake. The Level II ADR may include an analysis of loading reductions.

Se concentration (mg/kg dry weight)	DWQ Response
9.8	Aquatic life use declared as threatened. Initiate preliminary TMDL studies to evaluate selenium loading sources.
12.5	Aquatic life use declared as impaired. Formalize and implement TMDL.

# Toxics Parameter Assessments for All Waters

DWQ identifies toxics as all parameters within [UAC R317-2-14](#) that are not defined as conventional parameters (see Table 11 and the Lakes, Reservoirs, and Ponds Assessment section).

Data are compared against one or more toxic criteria, depending on the beneficial use, to ensure protection of designated beneficial uses. One daily measurement at each monitoring location is compared to the chronic and/or acute criteria for 303(d) assessment purposes. DWQ targets dissolved metals sample collection in lakes at one meter above the bottom of the deepest site of the waterbody, as this location is the most likely to identify dissolved metal exceedances in a lake. Dissolved metals are also assessed through this method when additional metals data are available for other lake locations or depths. The acute and chronic averaging periods defined in [UAC R317-2-14](#) are not currently applied for 303(d) assessment analysis because monitoring and sampling frequencies are different and more widely spaced than the acute and chronic periods typically defined in this rule.

## ***EQUATION-BASED TOXIC PARAMETERS***

A number of toxic criteria are specified as equations rather than specific values (see footnotes in [UAC R317-2-14](#)). The equations include variables of other chemical constituents or water properties that either reduce or magnify the extent to which a toxic is harmful to aquatic life. In order to properly apply the correction factor equations, DWQ uses measured data for the variables in the equation to calculate the appropriate numeric criteria for the sample. In order to calculate the correct criterion for a pollutant-result value, the monitoring location site and date of sample must match for the pollutant of concern and the additional parameter(s) that are needed to complete the equation. In the case where there are missing supplemental data values to apply the equation, the following rules will be applied.

**Hardness-dependent toxics:** For hardness-dependent criteria where a calcium (Ca) or magnesium (Mg) value is missing and the hardness cannot be calculated, a hardness value reported from the laboratory will be used. Data without a hardness value are removed from assessments.

**Aluminum, chronic only:** If either a field pH or calculated or laboratory hardness is missing, the aluminum acute default value of 750 microgram per liter ( $\mu\text{g/L}$ ) provided in Table 2.14.2 of [UAC R317-2](#) will be applied. Otherwise, the following pH and hardness combination and numeric criteria are applied:

- a.  $\text{pH} \geq 7.0$  and (calculated or laboratory reported) hardness  $\geq 50$  parts per million (ppm): 750  $\mu\text{g/L}$
- b.  $\text{pH} < 7.0$  and (calculated or laboratory reported) hardness  $\geq 50$  ppm: 87  $\mu\text{g/L}$
- c.  $\text{pH} \geq 7.0$  and (calculated or laboratory reported) hardness  $< 50$  ppm: 87  $\mu\text{g/L}$
- d.  $\text{pH} < 7.0$  and (calculated or laboratory reported) hardness  $< 50$  ppm: 87  $\mu\text{g/L}$

**Ammonia, chronic:** DWQ assumes fish early life stages are present at all monitoring locations. The following equation is used:  $((0.0577/(1+107.688-\text{pH})) + (2.487/(1+ 10\text{pH}-7.688))) * \text{MIN}(2.85, 1.45*100.028*(25-T))$ . Where  $(1.45*100.028*(25-T))$  is  $\leq 2.85$ ,  $(1.45*100.028*(25-T))$  is applied and if  $(1.45*100.028*(25-T))$  is  $> 2.85$ , 2.85 is applied. However, if a field pH or temperature reading is unavailable, a correction factor cannot be made and the result value for ammonia will be removed from the assessment.

**Ammonia, acute:** If a field pH is missing, a correction factor cannot be made, and the result value for ammonia will be removed from the assessment.

## ASSESSMENT PROCESS

Once chronic and acute criteria are calculated, toxicant sampling results, where applicable, are compared to the criteria to determine if the monitoring location is supporting beneficial uses or is impaired due to exceedances of the standard. Sites with sufficient data (four or more samples) with two or more exceedances of the acute and/or chronic criteria will result in non-support of the beneficial use. Four or more samples will be required with one or zero samples exceeding acute or chronic criteria for sites to meet beneficial uses. In cases where there are fewer than four samples, and one or zero samples are exceeding the acute or chronic criteria, sites will be placed in Category 3, insufficient data (Figure 17).

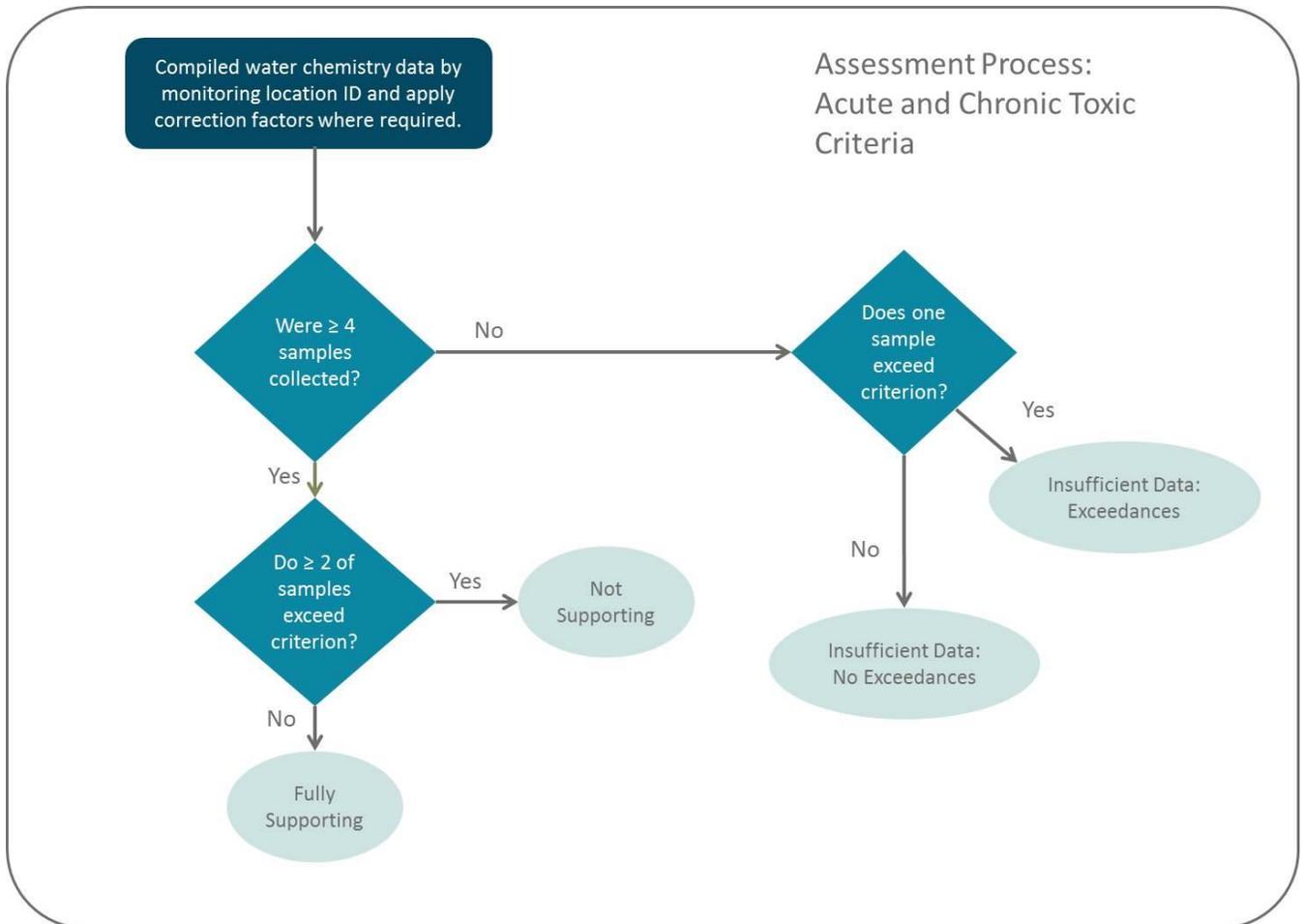


Figure 17. Overview of the assessment process for toxic parameters.

# Escherichia Coli Assessment for All Waters

## DATA PREPARATION

Following a credible data review and additional QA/QC checks as outlined in DWQ's Quality Assurance Program Plan for Environmental Data Operations (DWQ, 2014), DWQ compiles all credible data within the period of record of concern and makes several adjustments based on the reported limits and sampling frequencies necessary to conduct the assessment. Similar to the other QA/QC and assessment procedures outlined in this document, the raw data and accompanying metadata values in *Escherichia coli* (*E. coli*) datasets are not altered. Instead, DWQ uses a series of database comments and flags.

### Recreation Season

To ensure protection of recreation uses, *E. coli* assessments will be conducted on data collected during the recreation season from May 1 through October 31. The recreation season may be adjusted to be either longer or shorter based on site-specific conditions. Any site-specific adjustments made to the recreation season will be documented.

### Escherichia coli Collection Events and Replicate Samples

Datasets at a single monitoring location may contain replicate samples or multiple samples collected in the same day due to sampling design. Single daily values or collection events are required for *E. coli* assessments. DWQ defines a collection event as one of the following:

- The daily most probable number (MPN) result value
- A geometric mean of replicates where multiple samples are collected on the same day
- The daily MPN as a quantified value reported as being obtained from a dilution

In cases where replicate samples were taken and there is 1) a quantified MPN value reported from a dilution and 2) the MPN value reported is greater-than-detect, the quantified MPN value will be used as the collection event for assessment purposes. In this scenario, MPNs reported as greater-than-detect are not used to calculate the geometric mean for the collection event.

### Data Substitution for Calculating the Geometric Mean

Assessments use the geometric mean of representative samples to determine if *E. coli* standards are met. *E. coli* data that are reported as less- than-detect (< 1) or 0 will be treated as a value of 1 to allow for the calculation of a geometric mean. Similarly, *E. coli* data that are reported as greater-than-detect (> 2,419.6) will be treated as 2,420 to allow for the calculation of the geometric mean.

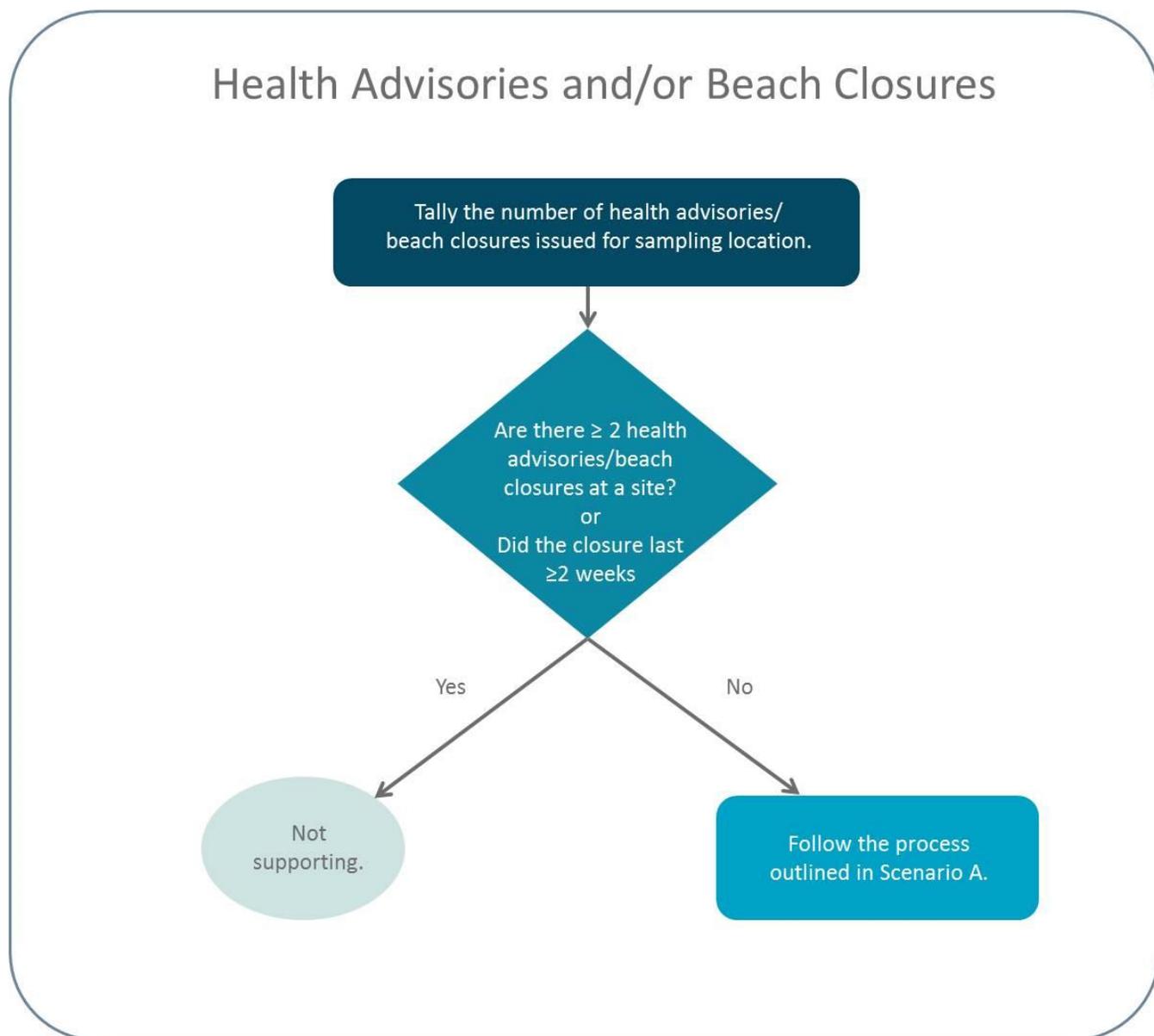
### Use Designation

DWQ assesses use support for each monitoring location once the data are compiled. All waters of the state are classified for contact recreation (Class 2), and some waters are classified as drinking water sources (Class 1C). These uses have specific associated *E. coli* standards that are used to determine use support. The numeric criteria within [UAC R317-2-14](#) are applied to Class 2 and Class 1C uses based on the beneficial use assignments to a waterbody or segment within a waterbody.

### Annual Recreation Season Assessment

DWQ begins the assessment process by gathering information on health advisories and/or closures issued during the recreation season. If a waterbody had two or more *E. coli*-related beach closures and/or health advisories in a recreation season, or if a health advisory and/or closure was issued for recreational access to a waterbody for two or more weeks, the waterbody is considered impaired and no further assessment is

conducted (Figure 18). If there were fewer than two closures or advisories, or if the closure lasted less than two weeks, the assessment process continues using *E. coli* concentrations.



**Figure 18. Considering *E. coli*-related beach closures and/or health advisories.**

To ensure protection of recreation and drinking water uses of assessed waterbodies of the state, DWQ considers three scenarios based on sampling frequency and the number of collection events at a monitoring location:

- Scenario A: A seasonal assessment against the maximum criterion (Figure 19)
- Scenario B: A 30-day geometric mean assessment (Figure 20)
- Scenario C: A seasonal geometric mean assessment (Figure 21)

## Scenario A

If there are greater than or equal to five collection events spaced 48 hours or more apart within a recreation season, then all collection events within the recreation season are used to make an assessment (see Figure 19).

- DWQ does not make impairment decisions based on one exceedance. If the monitoring location has less than 10 collection events within a recreation season, then one collection event may exceed the numeric criterion and the site will still be considered in Scenarios B and C. If two or more collection events exceed the numeric criterion, then the monitoring location is not supporting the beneficial use, and the next beneficial use is assessed.
- If there are 10 or more collection events within a recreation season, a percent exceedance is calculated by dividing the number of collection events that exceed the maximum criterion by the total number of collection events. If the calculated percentage is 10% or less, the monitoring location is then assessed using Scenarios B and C. If the calculated percentage is greater than 10%, the monitoring location is not supporting its beneficial use, and the next beneficial use is assessed.
- If there are less than five collection events spaced 48 hours or more apart within a recreation season, then the monitoring location is placed in the insufficient data category.
- If one or more collection events exceed the maximum criterion, then the monitoring location is placed in the insufficient data with exceedances category.
- If no collection events exceed the maximum criterion, then the monitoring location is placed in the insufficient data, no exceedances category.

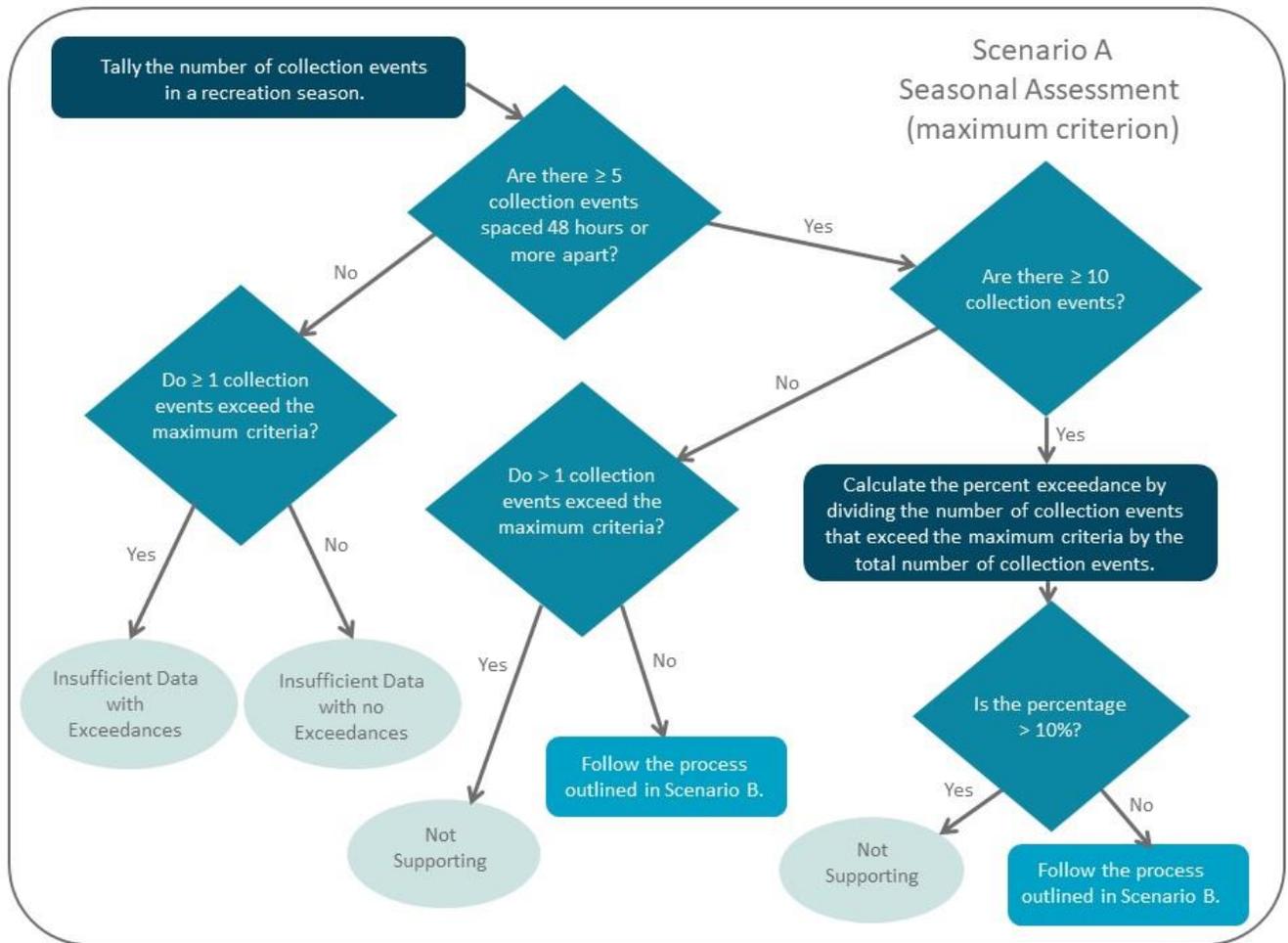


Figure 19. Scenario A: A seasonal assessment using the maximum criterion at a monitoring location.

### Scenario B

If the site's calculated percent exceedance of the maximum criterion is less than or equal to 10%, the site is then assessed using the 30-day geometric mean criterion (see Figure 20). There must be a minimum of five collection events in 30 days with at least 48 hours between collection events in order to assess against the 30-day geometric mean criterion directly. This ensures that collection events are adequately spaced and are representative of ambient conditions.

*Step 1:* Determine if there are  $\geq 5$  collection events within a 30-day period.

- Count the number of collection events collected between each sample date (day 1) and the sample date plus 29 days (day 30).

*Step 2:* Determine if the collection events are representative (must have  $\geq 5$  collection events within a 30-day period).

- Count the number of collection events collected between each sample day (day 0) and the sample date plus 2 days (day 3).
- If there are two collection events within this period, only one sample will be considered representative.

Step 3: Calculate the 30-day geometric mean.

- If there are  $\geq 5$  representative samples in a 30-day period, then all collection events will be used to calculate the 30-day geometric mean.
- If  $\geq 1$  30-day geometric mean exceeds the 30-day criteria, the site is not supporting beneficial uses. If there are not representative data for Scenario B, or if the 30-day geometric mean did not exceed the 30-day criteria, the site is assessed using Scenario C.

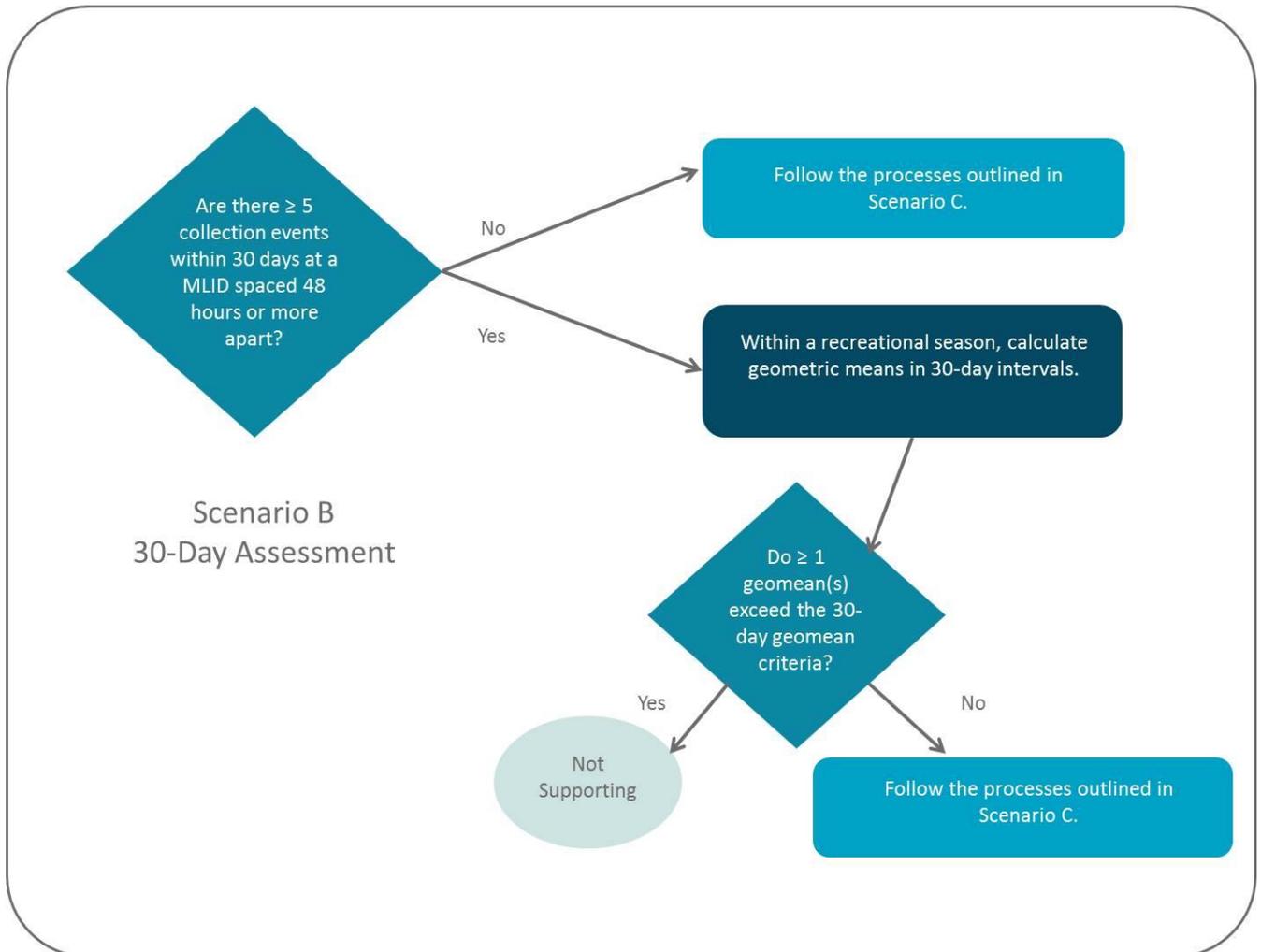


Figure 20. Scenario B: An assessment using the 30-day geometric mean for monitoring locations with five or more collection events within 30 days.

### Scenario C

If adequate (at least five samples) and/or representative data spaced by at least 48 hours are not available to assess against the 30-day geometric mean, DWQ will assess *E. coli* data for the recreation season, provided there are at least five collection events during the defined recreational season. Exceedances of the geometric mean criterion will result in the site being classified either as impaired (minimum of 10 collection events in a recreation season) or as insufficient data (sample size is more than five but fewer than 10) (see Figure 21).

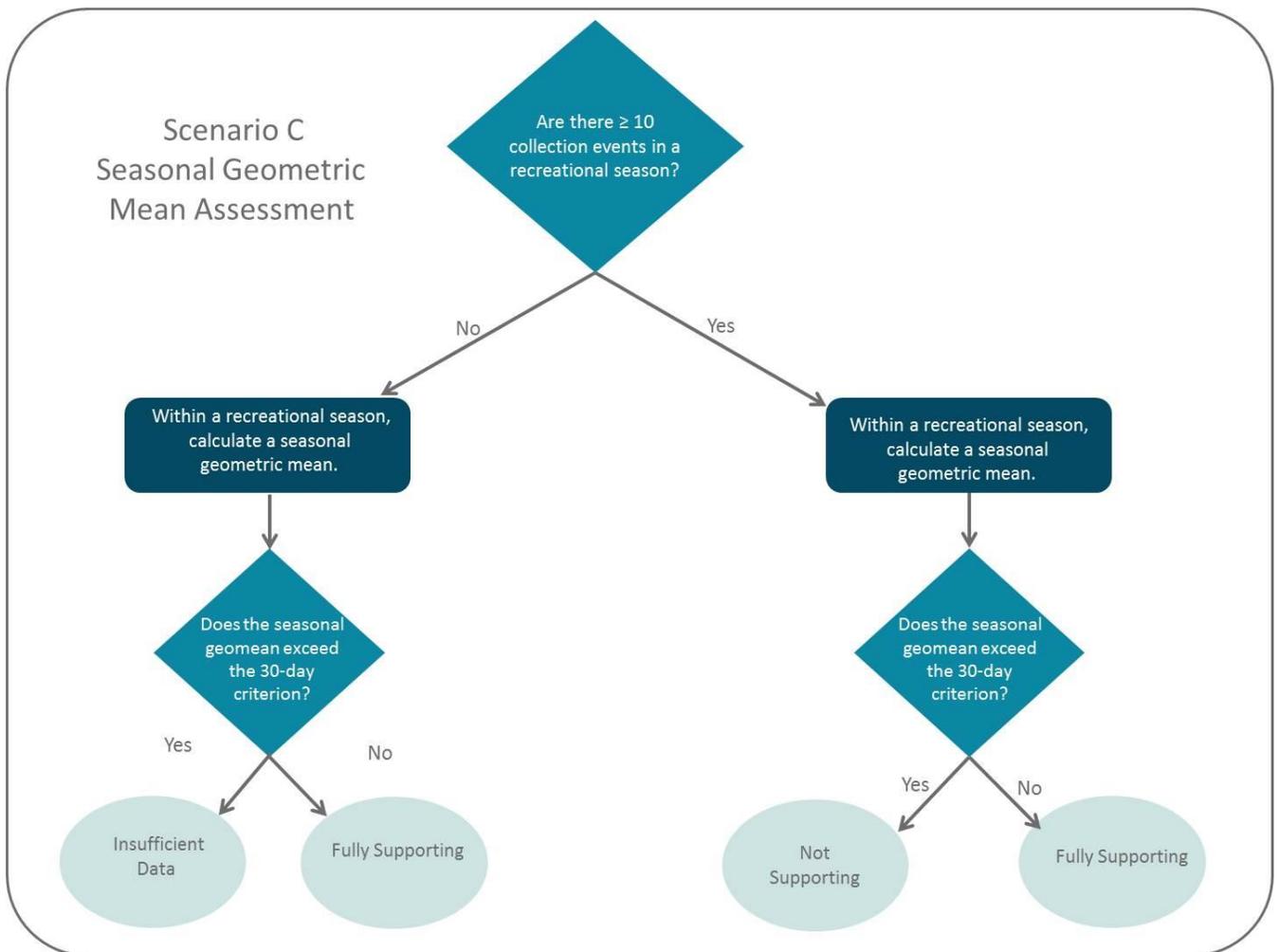


Figure 21. Scenario C: A seasonal geometric mean assessment.

### Summarizing Assessment Results

When determining beneficial use support of a monitoring location with assessment results across multiple years, the following rules are applied, in the following order:

#### Not Supporting (Category 5)

- A lake, reservoir, or pond has two or more posted health advisories or beach closures during any recreation season.
- Any monitoring location with five to nine collection events and two or more collection events that exceed the maximum criterion.
- Any monitoring location where the calculated percent exceedance of the maximum criterion within a recreation season for *E. coli* concentrations is greater than 10% for 10 or more collection events.
- Any monitoring location where the 30-day geometric mean exceeds the 30-day geometric mean criterion (minimum five collection events with at least 48 hours between collection events).
- Any monitoring location where the recreational season geometric mean exceeds the 30-day geometric mean criterion (minimum of 10 collection events).

### **Insufficient Data or Information Assessment Considerations (Category 3, with exceedances)**

- Sites with four or fewer samples in all seasons evaluated will be listed as insufficient data, provided impairment is not suggested by a posted health advisories or beach closures.

### **Combinations of Category 3 (with no exceedances), 2, and/or 1**

- If there is no evidence of impairment at a site by any of the assessment approaches over the period of record, the assessment analysis from the most recent year outweighs the results from previous years. DWQ's process for merging assessment results from multiple locations within an AU is discussed in more detail in Determinations of Impairment: All Assessment Units.

### **Supporting (Category 1 or 2)**

- No evidence of impairment by any assessment approach for all recreation seasons over period of record. A fully supporting determination can be made with a minimum of five collection events during the recreational season.

### **Combining *E. coli* with Other Parameter Assessment Results**

Until the determination of impairment and the review of additional supporting information are completed by reviewers, parameter assessments at an individual monitoring location and results from multiple monitoring locations within the same AU are not summarized and combined (see Determination of Impairment for more details).

## Pollutions Indicator Assessments for All Waters

Several parameters and beneficial uses in [UAC R317-2](#) are identified as pollution indicators and have footnotes indicating that further investigations should be conducted when levels are exceeded. To capture this footnote in the assessment process, DWQ reviews preliminary pollution indicator assessments during the Secondary Review process to determine whether pollution indicators demonstrate clear and convincing evidence of supporting or not supporting the beneficial uses assigned to the waterbody in [UAC R317-2](#). Secondary reviews incorporate pollution indicator data into assessment-category determinations and rely on multiple lines of evidence, including pollution indicator thresholds, the presence or absence of other indicator-associated water quality issues, potential pollutant sources, and other site- or watershed-specific knowledge, to determine whether listing or delisting on a pollution indicator parameter is appropriate or whether to prioritize waterbodies for additional monitoring.

## Narrative Standards for All Waters

Utah's water quality standards contain narrative criteria that protect beneficial uses in addition to the numeric criteria used to perform water quality assessments. The narrative criteria state:

*It shall be unlawful, and a violation of these rules, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor to taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentration or combinations of substance which produce undesirable human health effect, as determined by bioassay or other tests performed in accordance with standard procedures; or determined by biological assessments in (UAC) Subsection R317-2-7.3.*

DWQ will apply the narrative criteria to protect human health and aquatic life where evidence exists that human-caused actions have produced any of these undesirable outcomes in a waterbody. Narrative standards may be used to make an impairment determination for drinking-water closures, fish kills, harmful algal blooms (HABs), beach closures for swimming, and health advisories for the consumption of fish. Assessment of *E. coli* data and associated beach closures to protect human health provide an additional weight of evidence for defining the impairment of recreational uses and is addressed in more detail earlier in this document in the *Escherichia Coli* Assessment for All Waters section.

DWQ will assess a site as impaired for 1C uses if the Utah Division of Drinking Water or a local municipality issues an advisory or closure for a surface drinking water source, unless data show that the problem has been resolved.

### ***FISH KILLS***

DWQ requests information on reported fish kills from the Utah Division of Wildlife Resources and other stakeholders. These data are used with water quality data to make final assessment decisions. For example, sites that would generally not be assessed due to small sample sizes may be listed as impaired if fish kills have also been observed in the waterbody.

### ***HARMFUL ALGAL BLOOMS (HAB)***

For this IR cycle, harmful algal bloom (HAB) assessments are currently on hold while DWQ develops and reviews implementation guidance and assessment methods based on recent EPA recommendations for water quality criteria for cyanotoxins (see [Recommended Human Health Recreational Ambient Water Quality Criteria or Swimming Advisories for Microcystins and Cylindrospermopsins](#)). In future IR cycles, DWQ expects to continue assessing recreational uses for the occurrence of HABs.

### ***FISH TISSUE ASSESSMENTS AND CONSUMPTION HEALTH ADVISORIES***

DWQ has collected fish tissue samples for mercury analysis in waterbodies throughout the state since 2000. Consumption advisories have been issued for 24 waterbodies since then.

DWQ currently uses the EPA-published ambient water quality criterion for methylmercury for the protection of people who eat fish and shellfish. This criterion is 0.3 milligram (mg) methylmercury per kilogram (kg) fish tissue wet weight. If all fish (small and large) of the same species at a monitoring location have a mean mercury concentration of > 0.3 mg/kg, additional statistical tests are used to determine if a consumption advisory is necessary. If the mean is < 0.3 mg/kg, no advisory is issued. In several instances, size class

advisories have been issued when it is apparent that only the larger size class exceeds the safe consumption criterion.

The p-value is considered for locations with a mean mercury concentration of > 0.3 mg/kg. The p-value refers to the probability of obtaining a result equal to or greater than those that were measured at that location. DWQ uses a p-value of 0.05 to be 95% certain an advisory is not issued unnecessarily. Therefore, if a species has a mean of > 0.3 mg/kg and a p-value < 0.05, a consumption advisory is issued. If a species has a mean of > 0.3 mg/kg but a p-value of > 0.05, an advisory is not issued. The consumption advisories are based on long-term consumption; therefore, the mean is the most appropriate and commonly used parameter to estimate exposure.

In an effort to control for false negatives, DWQ calculates 95% confidence limits of the mean mercury concentration. If the upper confidence limit is above 0.3 mg/kg, that site is targeted for additional sampling.

When an advisory is warranted, DWQ sends the data to the Utah Department of Health toxicologist, who uses the mean mercury concentration to calculate the actual consumption recommendations. Those calculations are based on the following:

- Average adult weight: 70 kg (154 pounds). Average adult meal size: 227 grams (8 ounces)/meal
- Average child weight: 16 kg (35 pounds). Average child meal size: 113 grams (4 ounces)/meal

Consumption amounts are calculated for three target populations: pregnant women and children < 6 years old; women of child-bearing age and children between 6–16 years old; and adult women past child-bearing age and men >16 years old.

### Mercury Assessment Process

The current approach for mercury assessments for aquatic life is different than the consumption advisory process. The assessment is based on the U.S. Food and Drug Administration (FDA) recommended value of 1.0 mg/kg. The FDA set the consumption concentration at 1.0 mg/kg, which correlates to the water column mercury concentration of 0.012 µg/L identified in previous studies by EPA (EPA, 1985). Utah's water quality standard for mercury is 0.012 µg/L as a four-day average. Therefore, the corresponding fish tissue concentration of 1.0 mg/kg is used for assessment.

#### **Beneficial Use Supported (Category 1)**

- No fish consumption advisories for mercury are in place.
- Mean fish tissue mercury concentration for all individuals of the same species at a location is less than 0.3 mg/kg and p-value is < 0.5.

#### **Insufficient Data with Exceedances (Category 3)**

- Fish consumption advisories for mercury are in place, but the mean fish tissue mercury concentration for all individuals of the same species at a location is less than or equal to 1.0 mg/kg.

#### **Beneficial Use Not Supported (Category 5)**

- Fish consumption advisory for mercury is in place.
- Mean fish tissue mercury concentration is greater than 1.0 mg/kg.

For additional information and the most up-to-date list of consumption advisories, please visit [fishadvisories.utah.gov](http://fishadvisories.utah.gov).

## Determinations of Impairment: All Assessment Units

Each use and parameter within a waterbody is assigned a provisional EPA-derived assessment category after the initial assessment of credible data against the numeric criteria in [UAC R317-2](#). To verify the use and parameter-specific assessment results and consolidate the often multiple parameter assessments into one result per waterbody, DWQ must consider the quantity of data and the extent to which such data demonstrate clear and convincing evidence of supporting or not supporting the beneficial uses assigned to the waterbody. DWQ considers the following information to determine whether a waterbody is supporting or not supporting its beneficial uses:

- Individual assessment of water quality standards at a single site
- Independent applicability
- Multiple lines of evidence and several levels of secondary reviews

### ***INDIVIDUAL ASSESSMENT OF WATER QUALITY STANDARDS***

DWQ first considers the individual use and parameter-specific assessment results from the monitoring-location level data to determine whether a waterbody is supporting or not supporting the beneficial uses assigned in [UAC R317-2](#). Each use and parameter assessed for the waterbody is assigned a provisional EPA-derived assessment category. Unless noted in the waterbody-specific data assessment protocols, the assessment policies outlined in this document provide a direct and quantifiable method and documentation of data supporting or not supporting DWQ's water quality standards versus data and information that are developed using surrogate parameters or indicators. Because individual assessments at a single monitoring location site offer a more direct measure of supporting or not supporting water quality standards in [UAC R317-2](#), DWQ places a greater weight on individual assessment decisions that follow the data assessment protocols in this document.

DWQ looks across the multiple parameter-specific assessment results that exist for a location and consolidates the results into a preliminary assessment at the individual site level after review of the individual water quality standard assessments for a beneficial use. DWQ then assigns one EPA-derived assessment decision category as defined in Table 1 to each monitoring location.

### ***CONFLICTING ASSESSMENTS OF WATER QUALITY STANDARDS***

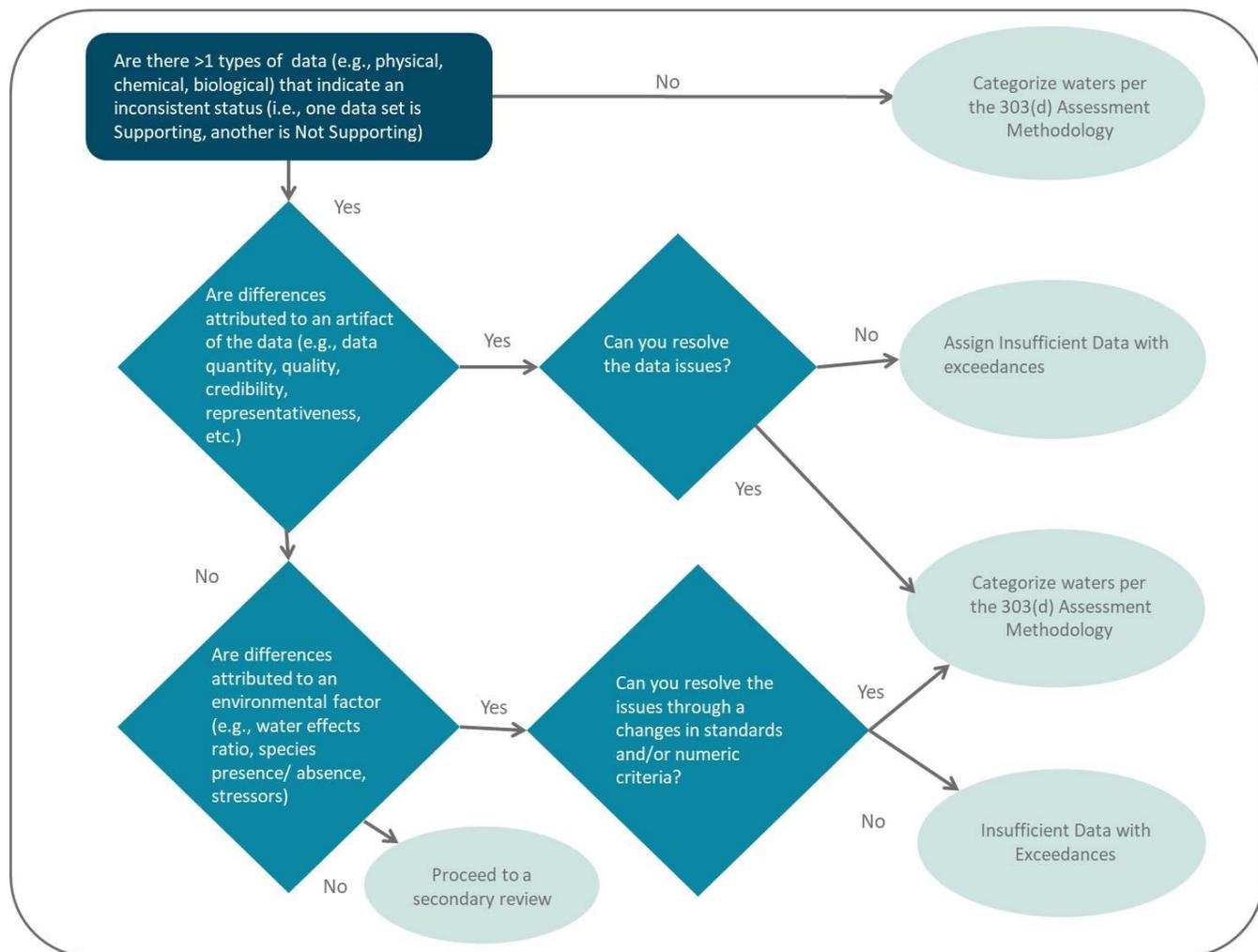
DWQ applies the policy of independent applicability to address the possibility of conflicting results among different types of data (e.g., biological versus conventionals, toxics versus *E.coli*) at the site and AU level and goes through a series of considerations to determine if discrepancies are due to

- Differences in data quality
- Environmental factors such as the application of the water-effects ratio, development of site-specific criteria, revision to numeric criteria in [UAC R317-2](#), or completion of a use attainability analysis

Figure 22 describes DWQ's use of the independent applicability policy.

Sites with conflicting assessment results may be listed as Category 3 (insufficient data and information). This allows DWQ to examine conflicting lines of evidence when concerns about the quality of independent datasets cannot be resolved through evaluation and documentation of the QA/QC issues that led to acceptance of one dataset and the resulting assessment result. Specific assumptions regarding model applicability applied during the biological assessment process are discussed in the Biological Assessment section. Similarly, if the application of water-effects ratio, justifiable site-specific criteria change, or change in beneficial uses based on a use attainability analysis cannot rectify the difference in the assessment results,

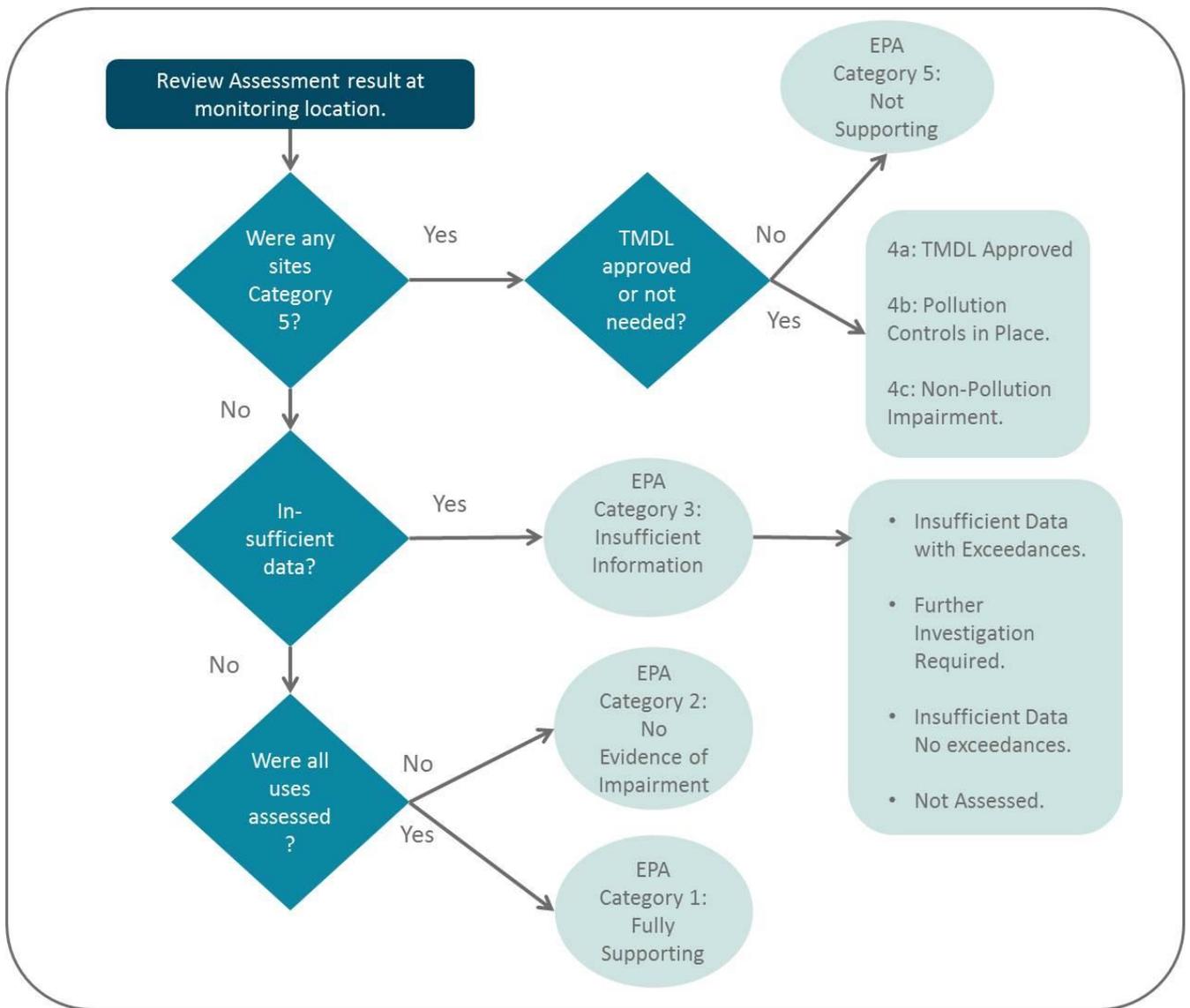
then a Category 3 may be warranted. All evaluations of conflicting assessment decisions will be made in consultation with EPA on a case-by-case basis.



**Figure 22. Overview of independent applicability process. Note: These judgment decisions are based in part on EPA’s Consolidated Assessment and Listing Methods guidance published in 2002.**

***AGGREGATION OF SITE-SPECIFIC ASSESSMENTS TO ASSESSMENT UNIT CATEGORIES***

For reporting purposes, DWQ aggregates all site-specific water quality assessments within an AU to a single assessment category for that AU as described in Table 1. A flowchart describing this process is presented in Figure 23 (see Appendix 4 for additional detail).



**Figure 23. Process of assigning EPA categories to AUs based on results of monitoring location assessments.**

**SECONDARY REVIEW**

DWQ conducts a secondary review of listing determinations after consolidation of all individual assessment results and assignment of preliminary assessment category(s) for an AU, The secondary review process allows DWQ to apply site/waterbody-specific knowledge and additional data quality controls to evaluate the extent to which data used in the preliminary assessment demonstrate clear and convincing evidence of supporting or not supporting the beneficial uses assigned to the waterbody in [UAC R317-2-6](#). DWQ recognizes that input from reviewers during public comment periods, in addition to the internal secondary review process, may provide key information on the data used in listing decisions. To ensure consistency in its use among different professionals, the secondary review process will be applied in a select number of scenarios using a standard set of guidelines as outlined in Appendix 3.

If documentation from the secondary review provides sufficient evidence to modify the basis and result of the preliminary assessment, the preliminary assessment decision based on the data assessment procedures

outlined in this document will be overwritten. For example, preliminary listings for Category 5, Category 1, or Category 2 waters could be re-assigned as Category 3, insufficient data and information.

The preliminary assessment decision based on the data assessment procedures outlined in this document will carry forward when documentation to override a preliminary assessment decision is insufficient, vague, or cannot be provided,

DWQ will document the original category assignment and a justification for the secondary review to ensure tracking and transparency.

### Assessment Unit Re-segmentation

DWQ may decide it is appropriate to re-segment (i.e. “split”) an existing AU polygon into two or more new AUs rather than aggregate those conflicting assessments into a single AU scale category when site-specific assessments within a single AU conflict. AUs where water quality criterion exceedances are clearly isolated to a relatively small, hydrologically distinct portion of the larger AU may be re-segmented to more accurately reflect that variation in water quality. For example, a large AU with an impairment isolated to a single tributary may be re-segmented into two AUs: one for the impaired tributary and another for the rest of the existing AU. Assessment categories for both AUs are then determined following standard aggregation (Figure 22 and the delisting procedures discussed in the Delistings section). This results in a higher resolution and overall more accurate assessment. DWQ does not consider it appropriate to re-segment an AU when exceedances are observed in multiple locations throughout an AU or where impaired sites are not hydrologically distinct from unimpaired portions of the AU.

If after aggregating all of the assessments into one assessment category for an AU, DWQ determines that the supporting or not supporting assessment result decision is not representative of the entire AU, DWQ will investigate further to determine whether the supporting or not supporting decision is widespread or limited to individual portions of the waterbody, such as specific tributaries or reaches. Results from the analysis will be categorized as follows:

**Entire AU not supporting (Category 5):** DWQ will recommend that the AU not be re-segmented and the entire AU be listed as not supporting. When data from multiple sites or tributaries within an AU indicate multiple (or a combination of) sites that do not support beneficial uses (Category 5) and insufficient data with exceedances (Category 3)

**Not supporting tributaries listed as not supporting (Category 5):** DWQ may recommend the AU be re-segmented into two AUs and that only the tributaries with data indicating impairment are listed as not supporting if data from one or more tributaries indicate a combination of any of the following:

- Insufficient Data with Exceedances (Category 3)
- No Evidence of Impairments (Category 2)
- Supporting (Category 1)
- Needs Further Investigations (Category 3)
- Insufficient Data with No Exceedances (Category 3)
- Not Assessed (Category 3)

The rest of the AU will be assigned a category following procedures as outlined in Figure 23.

## Identifying Causes of Impairments

DWQ will determine if the impairment or impairments are driven by pollutants, pollution, unknown, or natural causes once an AU is assigned an EPA assessment category that is representative of conditions in the AU (see Table 1). DWQ will identify causes of impairment by a pollutant with specific numeric water quality criteria identified in [UAC R317-2-14](#). Pollution is a generalized term for causes of water quality impairment that can include multiple pollutants and other factors such as the absence or lack of water, lack of riparian vegetation, and other modifications that affect a waterbody's ability to support aquatic habitat and other designated uses. With the exception of naturally occurring causes, only one cause will be applied to a not-supporting waterbody and parameter. Procedures on how DWQ identifies the cause of impairments are described in the section below.

### **POLLUTANTS**

DWQ uses CWA's definition as a guide to define pollutant-driven impairments (Category 5) as those resulting from the following:

*... dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under Atomic Energy Act of 1954, as amended), heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal, and agricultural waste discharged into water. ([UAC R317-2](#))*

DWQ also includes certain radiological constituents that are regulated under the state's Water Quality Control Act.

For the purpose of the 303(d) list, causes for impairments due to toxic parameters will be identified as the parameter for which there is an impairment. In the case of conventional parameters such as DO, temperature, pH, and biological scores, the cause will be assigned as the parameter that was assessed until a TMDL or pollution prevention plan identifies an alternative cause of the impairment.

DWQ will list the waterbody and the not-supporting parameter(s) as impaired for that pollutant (cadmium, iron, etc.) when an impairment for a waterbody or segment within a waterbody is identified as pollutant-driven. Waterbodies that are not supporting their beneficial uses due to pollutant impairments require future development of a TMDL or application of a TMDL alternative.

Where DWQ can identify that an impairment was not driven by a pollutant, it may consider whether the not-supporting assessment was driven solely by pollution versus a pollutant or by an unknown cause. DWQ will use CWA's definition of pollution as a guide when determining if an impairment resulted from "the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water." Waterbodies with not-supporting parameters that are driven solely by pollution problems do not require the future development of a TMDL and are candidates for a non-pollutant impairment (4C) assessment category. Details on DWQ's process for using EPA's 4C assessment category are described in section Category 4C.

### **UNKNOWN SOURCES**

For the purpose of the IR, sources of pollution contributing to an impairment will be reported in the 303(d) list to EPA as "unknown" until a TMDL or special study identifies the sources and any additional causes of impairment.

## ***NATURAL CONDITIONS***

DWQ will retain the not-supporting assessment decision in cases where it or a stakeholder can demonstrate that the natural conditions of the waterbody or segment within a waterbody are the key factors for an impairment(s). However, DWQ's response to such exceedances differs unless a site-specific standard has been promulgated. Site-specific standards require documentation that demonstrates the extent to which the violations were due to natural conditions. Proposed changes to standards will be developed once this documentation is assembled. Please review DWQ's [Standards](#) website for more information on the review and approval process for developing standards and numeric criteria for exceedances caused by naturally occurring conditions.

## Revising the 303(d) List and Other Categorical Assessments

Upon validating the strength and extent of the impairments within a waterbody or segment within a waterbody, DWQ includes newly proposed and previously listed not supporting (Category 5) waterbodies on the updated 303(d) list unless the waterbody or waterbody segment(s) is currently included in the IR's TMDL-approved (Category 4A), pollution control (Category 4B), non-pollutant impairment (Category 4C), or delisting lists. Details on how and when DWQ will not apply or carry an impaired listing (not supporting, Category 5) forward on DWQ's 303(d) list are described below.

### **CATEGORY 4A**

DWQ may choose to not list or remove an impaired waterbody or segment within a waterbody on the state's 303(d) list by calculating the maximum amount of a pollutant that a waterbody can receive while still meeting the state's water quality standards. This calculation and analysis work must be formalized in a TMDL and go through a thorough internal and external review process. This calculation and analysis work must be formalized in a TMDL that is provided to the public for review and comment, submitted to the Water Quality Board for approval, provided to the Legislative Natural Resources, Agriculture, and Environment Interim Committee for review if implementation costs exceed \$10 million or the full State Legislature for approval if implementation costs exceed \$100 million, and ultimately to EPA for their approval. Information on DWQ's process for developing and implementing a TMDL can be found on DWQ's [Watershed Management Program](#) website and EPA's [TMDL 303\(d\)](#) website. Where DWQ has documentation of a TMDL approved by the Water Quality Board and EPA for an impaired parameter within a not-supporting waterbody or segment within a waterbody, DWQ will override a current or previous not-supporting Category 5 listing decision at the AU level as follows:

#### **Whole AU Category 4A, TMDL-approved if:**

The only impairments within the waterbody or segment within the waterbody are included in the approved TMDL.

There are additional impairments within the waterbody or segments within the waterbody that are addressed in a Category 4B demonstration plan (described in section Category 4B and Appendix 5) and are not included in the approved TMDL. If the parameters included in the approved Category 4B demonstration plan are still not supporting or are insufficient data with exceedances in the current assessment cycle, DWQ will indicate that those parameters have an approved Category 4B demonstration plan in place.

There are additional impairments within the waterbody or segments within the waterbody that are pollution-driven (Category 4C) and not included in the approved TMDL. DWQ will indicate that those parameters are pollution versus pollutant driven if the pollution-driven parameters are still not supporting or are insufficient data with exceedances in the current assessment cycle.

#### **Whole AU Category 5, Not Supporting if:**

There are any additional pollutant impairments within the waterbody or segments within the waterbody that are not included in the approved TMDL. DWQ will indicate that those parameters have an approved TMDL in place if the parameters included in the approved TMDL are still not supporting or are insufficient data with exceedances in the current assessment cycle.

## ***CATEGORY 4B***

DWQ may choose to not list or remove an impaired waterbody or segment within a waterbody on the state's 303(d) list by developing a plan that ensures, upon implementation, that the waterbody will meet state water quality standards within a reasonable time period and through state- and EPA-approved pollution-control mechanisms. Similar to a TMDL, a Category 4B demonstration plan must go through a robust internal and external review process. Once DWQ or a stakeholder develops a plan for consideration, DWQ will present the plan to the Water Quality Board and submit the board-approved plan to EPA for final approval. More information on the Category 4B demonstration plan process can be found in Appendix 5 and in EPA's [Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303\(d\), 305\(b\) and 314 of the Clean Water Act](#) and [Information Concerning 2008 Clean Water Act Sections 303\(d\), 305\(b\), and 314 Integrated Reporting and Listing Decisions](#).

Where DWQ has documentation of an EPA-approved Category 4B demonstration plan for an impaired parameter within a not-supporting waterbody or segment within a waterbody, DWQ will override a current (or previous) not-supporting Category 5 listing decision at the AU level as follows:

### **Whole AU Category 4A, TMDL-approved if:**

There are any additional impairments within the waterbody or segments within the waterbody that are addressed in an approved TMDL (Category 4A) and are not included in the approved Category 4B demonstration plan. DWQ will indicate that those parameters have an approved Category 4B demonstration plan in place if the parameters included in the approved Category 4B demonstration plan are still not supporting or are insufficient data with exceedances in the current assessment cycle.

### **Whole AU Category 4B, Pollution Control if:**

The only impairments within the waterbody or segment within the waterbody are included in the approved Category 4B demonstration plan.

There are additional impairments within the waterbody or segments within the waterbody that are pollution driven (Category 4C) and are not included in the approved Category 4B demonstration plan. DWQ will indicate that those parameters are pollution rather than pollutant driven if the pollution-driven parameter impairments are still not supporting or are insufficient data with exceedances in the current assessment cycle.

### **Whole AU Category 5, Not Supporting if:**

There are any additional pollutant impairments within the waterbody or segments within the waterbody that are not included in the approved Category 4B demonstration plan. DWQ will indicate that those parameters have an approved Category 4B demonstration plan in place if the parameters included in the approved Category 4B demonstration plan are still not supporting or are insufficient data with exceedances in the current assessment cycle.

## ***CATEGORY 4C***

DWQ may choose to not list or remove an impaired waterbody or segment within a waterbody on the state's 303(d) List is to demonstrate that the parameter-specific impairment (or impairments) is driven by pollution and not by a pollutant or pollutant that causes pollution. Unlike a TMDL or Category 4B demonstration plan, the analysis tries to determine if the cause of impairment is driven by pollution and does not require formal approval from the Water Quality Board or EPA. Pollution analysis work is instead reviewed internally by DWQ and by stakeholders during the public comment period of the draft IR and 303(d) list.

For the draft IR and 303(d) list, DWQ will temporarily assume “approval” of any pollution-driven analysis work and supersede a current or previous not supporting Category 5 listing decision at the AU level as follows:

**Whole AU Category 4A, TMDL-approved if:**

All impairments within the waterbody or segments within the waterbody are addressed in an approved TMDL (Category 4A). DWQ will indicate that those parameters are pollution- rather than pollutant-driven for pollution-driven impairments that are still not supporting or are insufficient data with exceedances in the current assessment cycle.

**Whole AU Category 4B, Pollution Control if:**

All impairments within the waterbody or segments within the waterbody are addressed in an approved Category 4B demonstration plan. DWQ will indicate that those parameters are pollution driven for pollution-driven impairments that are still not supporting or are insufficient data with exceedances in the current assessment cycle.

**Whole AU Category 4C, Non-Pollutant Impairment if:**

The only impairments within the waterbody or segment within the waterbody are included in the approved Category 4B demonstration plan.

**Whole AU Category 5, Not Supporting if:**

There are any additional pollutant impairments within the waterbody or segments within the waterbody. DWQ will indicate that those parameters are pollution-driven for pollution-driven impairments that are still not supporting or are insufficient data with exceedances in the current assessment cycle.

DWQ will provide stakeholders with draft IR and 303(d) list documentation during the public comment period to demonstrate why the impaired parameter within the waterbody or segment within the waterbody is pollution- and not pollutant-driven and will not require the future development of a TMDL.

## ***DELISTINGS***

The fourth and final alternative DWQ has at its disposal is to demonstrate good cause to stakeholders and EPA that a previously impaired parameter and waterbody or segment within a waterbody is now meeting water quality standards in [UAC R317-2](#). Good cause occurs when DWQ can demonstrate one or more of the following categories and scenarios:

### **Improvements in Watershed Conditions**

The waterbody has improved due to implementation of nonpoint source projects and/or revised effluent limits and post-implementation data indicate that the impairment has been resolved. This assessment may be based on additional data beyond that which is typically used in assessments, including before-and-after project implementation monitoring. In some cases, demonstration of improvement may be based on a different time period for data collection that corresponds with known watershed improvements.

### **Changes to Water Quality Standards**

Adoption of revised water quality standards and/or uses so the waterbody now meets the revised standards and/or uses.

### **Changes to the 303(d) Assessment Methods**

Development of a new listing method consistent with the state water quality standards and classifications and federal listing requirements. This includes all information contained in this document and posted on DWQ's [Call for Data](#) webpages.

### **Reassessment (new data and information)**

Assessment and interpretation of older data that was not originally included in the previous assessment and/or more recent or more accurate data that demonstrate that the applicable classified uses and numeric and narrative standards are being met.

### **Geo-location Information Error**

Inappropriate listing of a water that is located within Indian country as defined in 18 United States Code 1151.

### **Analysis Errors**

Flaws in the original analysis of data and information that led to the waterbody-pollutant combination being incorrectly listed. Such flaws may include the following: (1) calculation errors in the data assessment methods outlined in the 303(d) assessment methods from that assessment cycle; (2) errors produced when reviewing credible and representative data information; (3) mapping errors generated during the validation of monitoring location information and assigning AU designations; (4) discrepancies between the beneficial use assignments in [UAC R317-2](#) and the IR geo-location information files for internal and external data; (5), incorrect identification and assessment of a waterbody type; and (6) application of the wrong numeric criteria to a beneficial use.

### **New Modeling**

Results of more sophisticated water quality modeling that demonstrate that the applicable classified uses and numeric and narrative standards are being met.

### **Effluent Limitations**

Demonstration pursuant to 40 CFR 130.7(b)(1)(ii) that there are effluent limitations required by state or local authorities that are more stringent than technology-based effluent limitations required by the CWA and that these more stringent effluent limitations will result in support of classified uses and numeric and narrative standards for the pollutant causing the impairment.

### **Other**

There is other relevant information that supports the decision not to include the segment on the Section 303(d) list.

In order to justify a delisting of an AU for a given parameter based on new data, the dataset must be of sufficient quantity and quality to make an assessment. There are two mechanisms for justifying a delisting based on assessment results:

- Delisting an AU for all parameters
- Delisting individual parameters for an AU

DWQ will compare the previous IR cycle's final assessment categories and 303(d) list to the current IR's assessment categories and 303(d) list to demonstrate good cause. Where differences in categorical assignments exist, DWQ will only further investigate the following scenarios for good cause:

- The AU/waterbody or segment within the waterbody was previously not supporting (Category 5) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- The AU/waterbody or segment within the waterbody was previously not supporting but had an approved TMDL (Category 4A) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- The AU/waterbody or segment within the waterbody was previously not supporting but had an approved Category 4B demonstration plan and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- The AU/waterbody or segment within the waterbody was previously not supporting but had pollution-driven impairment (Category 4C) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).

**Note:** The next set of scenarios describes the methods that apply to delisting individual parameters rather than entire AUs.

- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting (Category 5) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting but had an approved TMDL (Category 4A) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting but had an approved Category 4B demonstration plan and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).
- A parameter within an AU/waterbody (or segment within the waterbody) was previously not supporting but had pollution-driven impairment (Category 4C) and is now supporting (Category 1), shows no evidence of impairment (Category 2), or has insufficient data with no exceedances (Category 3).

Where assessment category assignments at the AU- and parameter-level warrant a further investigation for good cause, DWQ will reevaluate the data using the following:

- The period of record from when the AU and/or parameter was first listed
- The period of record in the current assessment cycle
- The data that were collected between when the AU and/or parameter were first listed and the period of record considered in the current assessment cycle

DWQ will review the data from all assessed sample locations (as defined in Table 4) in the three above scenarios as part of the demonstration-of-good-cause process to confirm whether there were exceedances at the sample sites. Where exceedances occur, DWQ must demonstrate that the exceedances no longer exist, no longer are of concern, or that water quality has improved. DWQ will provide documentation and a justification as to why the site was not re-sampled and/or whether water quality conditions have improved if a sample site had exceedances and newer data do not exist. If documentation cannot be provided, the AU and parameter will not be delisted, and the previous categorical assignment will carry forward.

### Delisting Categorical Pollutant Causes

When TMDLs or special studies identify parameters contributing to a cause of impairment that is not the original cause for listing on the 303(d) list, there may be good cause justification for delisting the categorical cause if the original impaired parameter is no longer impaired and a linkage of the additional causes can be documented in a TMDL or other study. For instance, in some circumstances DWQ has identified phosphorus as a contributing cause of impairment to an existing DO listing and subsequently made a categorical listing for

phosphorus as a cause on subsequent 303(d) lists. Since DWQ does not have assessment methods for phosphorus, a delisting based on the process outlined here is not feasible. Therefore, if the assessment results for the original DO listing can justify a delisting, any additional parameters associated with that cause may also be delisted with proper documentation of a direct linkage.

Appendix 6 elaborates on the process DWQ will follow when evaluating good cause at the AU-level and also describes, in more detail, the process DWQ will go through when evaluating good cause at the parameter level. DWQ applies several delisting codes for EPA review and approval (also included in Appendix 6).

If a waterbody or parameter is shown to have good cause for not being listed or removed as an impaired waterbody or segment within a waterbody on the state's 303(d) list, DWQ will state the good cause and provide a detailed description of the good cause. Details of the good-cause evaluation process, such as the data-analysis work, will not be posted online during the draft public comment period or after the final approval and publication of the final IR and 303(d) list. DWQ will, however, summarize the data analysis work in the description of the good cause. The analyses will be available to the public upon request through [Utah's Government Records Access and Management Act \(GRAMA\)](#) process.

## ***PREVIOUS CATEGORICAL LISTINGS***

### **303(d) Listings**

DWQ must continue to list all previous impairments absent proper documentation to support changing a previous not-supporting (Category 5) listing decision to a TMDL-approved (Category 4A), pollution control (Category 4B), non-pollutant impairment (Category 4C), or delisting (demonstration of good cause). At a minimum, this includes carrying forward all waterbodies or segments within a waterbody that were previously not supporting (Category 5), indicating the cause of impairment, listing the beneficial use or uses failing to meet water quality standards, providing the priority of developing a TMDL, and indicating the assessment cycle the waterbody or segment within the waterbody was first listed.

### **Non-303(d) Categorical Listings**

Where DWQ has the proper documentation to support changing a previous not-supporting (Category 5) listing decision to a TMDL-approved (Category 4A), pollution control (Category 4B), non-pollutant impairment (Category 4C), or delisting (demonstration of good cause), it will do so as outlined by the policies and procedure described throughout this document.

DWQ will also carry forward all previous categorizations of waterbodies or segments within a waterbody if the waterbody does not have any credible or representative data from the period of record of the current assessment cycle. This includes carrying the following forward:

- Previous TMDL-approved (Category 4A), pollution control (Category 4B), and non-pollutant impairment (Category 4C) categorizations that do not demonstrate good cause.
- Previous categorizations that have insufficient data with exceedances (Category 3), require further investigations (Category 3), have insufficient data with no exceedances (Category 3), are not assessed (Category 3), show no evidence of impairment (Category 2), or are supporting (Category 1).
- Historical Category 3 waters that had insufficient data with exceedances will remain in that category unless there is new data for assessment.

Waterbodies or segments within a waterbody that are supporting or show no evidence of impairment (Categories 1 and 2, respectively) may carry forward for six consecutive assessment (or two rotating basin) cycles. On the seventh consecutive assessment cycle, DWQ will no longer carry forward a supporting or no evidence of impairment categorization for waterbodies or segment within a waterbody that do not have any

new data collected in the last 12 years. Data older than the period of record may not be reflective of current conditions and will not be used for assessment purposes unless there is information or a rationale with supporting documentation that shows the data are reflective of current conditions.

If there is evidence that the data are reflective of current conditions, the previous supporting (Category 1) or no evidence of impairment (Category 2) categorization will carry forward for one more assessment cycle (the current one) and be re-evaluated in the next cycle. DWQ will not carry forward the supporting or no evidence of impairment categorization for a seventh consecutive assessment cycle if there is no (or not enough) supporting evidence that the data are reflective of current conditions. DWQ will instead change the categorization to insufficient data with no exceedances (Category 3).

## 303(d) Vision and TMDL Priority Development

DWQ must ensure that TMDLs will be developed following the final release of the current IR and 303(d) list for waterbodies or segments within a waterbody that are impaired by a pollutant. Recognizing that all TMDLs cannot be completed at once and that certain risks may be greater than others, CWA Section 303(d) allows states to prioritize impaired waterbodies or segments within a waterbody on the Section 303(d) list for the future development of TMDLs.

On December 5, 2013, EPA announced a collaborative framework for implementing the CWA Section 303(d) program to help guide states on how to best prioritize TMDL development and demonstrate progress on addressing the water quality concerns highlighted and reported on in the IR and 303(d) list (See [A Long-Term Vision for Assessment, Restoration, and Protection under the Clean Water Act Section 303\(d\) Program](#)). This EPA document provides a framework that states can use to optimize their resources when developing TMDLs and other water quality improvement programs such as the anti-degradation program, nonpoint source implementation program, and the 401 water quality certification program. DWQ worked with stakeholders after the release of this document and developed new policies and procedures for the following IR and 303(d) reporting-specific elements:

- Assigning TMDL priorities to impaired waterbodies and segments within waterbodies on DWQ's 303(d) list
- Performing cost–benefit analyses that estimate the environmental, economic, and social costs and benefits, and time needed to achieve the objectives of CWA and state water quality standards
- Tracking the status and development of TMDLs

Please refer to Appendix 7 to learn more about DWQ's prioritization process for the development of future TMDLs contained on DWQ's 303(d) list.

## Revision Requests between Cycles

DWQ will, barring unforeseen circumstances, only propose to revise the IR and 303(d) list during the regularly scheduled reviews, which are currently biennially and on even-numbered years. Interested persons may petition DWQ at any time to request a revision to the IR and 303(d) list, whether it is an addition or deletion to the final 303(d) list. However, such revisions may only be considered if failing to add a segment to the list or delete a segment from the list before the next scheduled review will result in a substantial hardship to the party or parties requesting the revision(s). DWQ will take the potential revision under strong consideration and begin a dialogue with the interested party or parties and EPA if such hardship is shown.

## Literature Cited

- Carlson, R.E. 1977. A Trophic Status Index for Lakes. *Limnology and Oceanography* 22:361–364.
- Carlson, R.E., and K.E. Havens. 2005. Simple graphical method for interpretation of relationships between trophic state variables. *Lake and Reservoir Management* 21:107-118.
- Clarke, R.T., M.T. Furse, J.F. Wright, and D. Moss. 1996. Derivation of a biological quality index for river sites: comparison of the observed with the expected fauna. *Journal of Applied Statistics* 23:311–332.
- Davies, N.M, R.H. Norris, and M.C. Thoms. 2000. Prediction and assessment of local stream habitat features using large-scale catchment characteristics. *Freshwater Biology* 45:343–369.
- EPA. 2016. Human health recreational ambient water quality criteria or swimming advisories for Microcystins and Cylindrospermopsin.
- Feldman, D. 2006. A Report to the DEQ Water Quality Planning Bureau on the Proper Interpretation of Two Recently Developed Bioassessment Models. Helena, Montana: Montana Department of Environmental Quality.
- Furse, M.T., D. Moss, J.F. Wright, and P.D. Armitage. 1984. The influence of seasonal and taxonomic factors on the ordination and classification of running-water sites in Great Britain and on the prediction of their macro-invertebrate communities. *Freshwater Biology* 14:257–280.
- Hargett, E.G., J.R. ZumBerge, and C.P. Hawkins. 2005. Development of a RIVPACS Model for Wadable Streams of Wyoming. Wyoming Department of Environmental Quality, Water Quality Division.
- Hawkins, C.P. 2004. Predictive Model Assessments: A Primer. The Western Center for Monitoring and Assessment of Freshwater Ecosystems, Utah State University, 29 September 2004. Available at: [https://qcnr.usu.edu/wmc/predictive\\_models/model\\_primer](https://qcnr.usu.edu/wmc/predictive_models/model_primer).
- Hawkins, C.P., 2006. Quantifying biological integrity by taxonomic completeness: its utility in regional and global assessments. *Ecological Applications*, 16(4), pp.1277-1294.
- Hawkins, C.P., and D.M. Carlisle. 2001. Use of Predictive Models for Assessing the Biological Integrity of Wetlands and Other Aquatic Habitats. In *Bioassessment and Management of North American Freshwater Wetlands*, edited by Russell B. Rader, Darold P. Batzer, and Scott A. Wissinger. Hoboken, New Jersey: John Wiley & Sons, Inc.
- Hawkins, C.P., Cao, Y. and Roper, B., 2010. Method of predicting reference condition biota affects the performance and interpretation of ecological indices. *Freshwater Biology*, 55(5), pp.1066-1085.
- Hawkins, C.P., Mykrä, H., Oksanen, J. and Vander Laan, J.J., 2015. Environmental disturbance can increase beta diversity of stream macroinvertebrate assemblages. *Global Ecology and Biogeography*, 24(4), pp.483-494.
- Hawkins, C.P, R.H. Norris, J.N. Hogue, and J.W. Feminella. 2000. Development and evaluation of predictive models for measuring the biological integrity of streams. *Ecological Applications* 10:1456–1477.
- Hawkins, C.P., Olson, J.R. and Hill, R.A., 2010. The reference condition: predicting benchmarks for ecological and water-quality assessments. *Journal of the North American Benthological Society*, 29(1), pp.312-343.
- Hawkins, C.P. and Yuan, L.L., 2016. Multitaxon distribution models reveal severe alteration in the regional biodiversity of freshwater invertebrates. *Freshwater Science*, 35(4), pp.000-000.

- Hughes, R.M., D.P. Larsen, and J.M. Omernik. 1986. Regional reference sites: a method for assessing stream potential. *Environmental Management* 5:629–635.
- Jessup, B., C.P. Hawkins, and J. Stribling. 2006. Biological Indicators of Stream Condition in Montana Using Benthic Macroinvertebrates. Tetra Tech. Technical report prepared for the Montana Department of Environmental Quality, Helena, Montana.
- Karr, J.R. 1981. Assessment of biotic integrity using fish communities. *Fisheries* 6:21–27.
- Karr, J.R., and D.R. Dudley. 1981. Ecological perspectives on water quality goals. *Environmental Management* 5(1):55–68.
- Lévesque, B., M. Gervais, P. Chevalier, D. Gauvin, E. Anassour-laouan-sidi, S. Gingras, N. Fortin, G. Brisson, C. Greer, and D. Bird. 2014. Science of the Total Environment Prospective study of acute health effects in relation to exposure to cyanobacteria. *Science of the Total Environment* 466-467:397–403.
- Lin, C. J., T. J. Wade, E. A. Sams, A. P. Dufour, A. D. Chapman, and E. D. Hilborn. 2016. A Prospective Study of Marine Phytoplankton and Reported Illness among Recreational Beachgoers in Puerto Rico, 2009.
- Marchant, R., and G. Hehir. 2002. The use of AUSRIVAS predictive models to assess the response of lotic macroinvertebrates to dams in south-east Australia. *Freshwater Biology* 43:1022–1050.
- Mazor, R.D., Rehn, A.C., Ode, P.R., Engeln, M., Schiff, K.C., Stein, E.D., Gillett, D.J., Herbst, D.B. and Hawkins, C.P., 2016. Bioassessment in complex environments: designing an index for consistent meaning in different settings. *Freshwater Science*, 35(1), pp.249-271.
- Metzeling, L., D. Robinson, S. Perris, and R. Marchant. 2002. Temporal persistence of benthic invertebrate communities in south-eastern Australian streams: taxonomic resolution and implications for the use of predictive models. *Marine and Freshwater Research* 53:1223–1234.
- Moss, D. J.F. Wright, M.T. Furse, and R.T. Clarke. 1999. A comparison of alternative techniques for prediction of the fauna of running-water sites in Great Britain. *Freshwater Biology* 41:167–181.
- Ostermiller, J.D. and Hawkins, C.P., 2004. Effects of sampling error on bioassessments of stream ecosystems: application to RIVPACS-type models. *Journal of the North American Benthological Society*, 23(2), pp.363-382.
- Ostermiller, J. D., M. Shupryt, M. A. Baker, B. Neilson, E. B. Gaddis, A. J. Hobson, B. Marshall, T Miller, D. Richards, N. vonStackelberg. 2014. Technical Basis for Utah's Nutrient Strategy, Draft Report. Utah Division of Water Quality.
- Paul, M. J., J. Gerritsen, C.P. Hawkins, and E. Leppo. 2005. Development of Biological Assessment Tools for Colorado. Tetra Tech. Technical report prepared for the Colorado Department of Public Health and Environment, Water Quality Control Division – Monitoring Unit, Denver, Colorado.
- Pilotto, L. S., R.M. Douglas, M.D. Burch, S. Cameron, M. Beers, G.J. Rouch, and C. Moore. 1997. Health effects of exposure to cyanobacteria (blue–green algae) during recreational water–related activities. *Australian and New Zealand Journal of Public Health*, 21(6), 562-566.
- Simpson, J.C., and R.H. Norris. 2000. Biological assessment of river quality: development of AusRivAS models and outputs. In *Assessing the Biological Quality of Fresh Waters*, edited by J.F. Wright, D.W. Sutcliffe, and M.T. Furse, pp. 125–142. Ambleside, United Kingdom: Freshwater Biological Association.

- Stewart, I., P. M. Webb, P. J. Schluter, L. E. Fleming, J. W. B. Jr, M. Gantar, L. C. Backer, and G. R. Shaw. 2006b. Epidemiology of recreational exposure to freshwater cyanobacteria – an international prospective cohort study. *BMC Public Health* 11:1–11.
- Sudaryanti, S., Y. Trihadiningrum, B.T. Hart, P.E. Davies, C. Humphrey, R.H. Norris, J. Simpson, and L. Thurtell. 2001. Assessment of the biological health of the Brantas River, East Java, Indonesia using the Australian River Assessment System (AUSRIVAS) methodology. *Aquatic Ecology* 35(2):135–146.
- Suplee, M., R. Sada de Suplee, D. Feldman, and T. Laidlaw. 2005. Identification and Assessment of Montana Reference Streams: A Follow-Up and Expansion of the 1992 Benchmark Biology Study. Helena, Montana: Montana Department of Environmental Quality.
- U.S. Environmental Protection Agency (EPA). 1985. Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and their Uses. EPA-PB85-227049.
- U.S. Environmental Protection Agency. EPA Requirements for Quality Assurance Project Plans. Office of Environmental Information. Washington: March 2002. (EPA/240/B-01/003).
- U.S. Environmental Protection Agency. Sampling Analysis Plan Guidance and Template, Version 4, General Projects. Washington: May 2014. (EPA R9QA/009.1).
- . 2005. Guidance for 2006 assessment, listing and reporting requirements pursuant to Sections 303(d) and 305(b) of the Clean Water Act. Available at: <http://www.epa.gov/owow/tmdl/2006IRG/report/2006irg-report.pdf>. Accessed September 19, 2014.
- U.S. Geological Survey (USGS). 2006. Guidelines and Standard Procedures for Continuous Water-Quality Monitors: Station Operation, Record Computation, and Data Reporting. Available at: <http://pubs.usgs.gov/tm/2006/tm1D3/pdf/TM1D3.pdf>. Accessed September 19, 2014.
- Utah Division of Water Quality (DWQ). 2014. Quality Assurance Program Plan For Environmental Data Operations. Final Plan. Available at: [http://www.deq.utah.gov/Compliance/monitoring/water/docs/2014/05May/DWQ\\_QAPP\\_5.1.14\\_Rev0.pdf](http://www.deq.utah.gov/Compliance/monitoring/water/docs/2014/05May/DWQ_QAPP_5.1.14_Rev0.pdf). Accessed September 19, 2014.
- Van Sickle, J., Larsen, D.P. and Hawkins, C.P., 2007. Exclusion of rare taxa affects performance of the O/E index in bioassessments. *Journal of the North American Benthological Society*, 26(2), pp.319-331.
- Wright, J.F. 1995. Development and use of a system for predicting the macroinvertebrate fauna in flowing waters. *Australian Journal of Ecology* 20:181–197.
- Wright, J.F., M.T. Furse, and P.D. Armitage. 1993. RIVPACS: a technique for evaluating the biological water quality of rivers in the UK. *European Water Pollution Control* 3:15–25.

# Appendix 1

## PRIORITY PARAMETERS

DWQ Parameter Name	DWQ Parameter Fraction	Recommended CAS Number	Parameters impacted by New/ Revised Assessment Methodology	DWQ Parameters Routinely Measured for Assessment Purposes	Required Additional Parameter Submissions for Complete Assessment Purposes	Additional Submission Considerations for QA/QC
<b>Fish Mercury</b>		n/a				
<b>Flow</b>	n/a	Field Measurement		X		
<b>pH</b>	n/a	Field Measurement		X		
<b>Secchi Depth</b>	n/a	Field Measurement		X	for Lake Samples only Accompanying Fluoride, Dissolved for Fluoride Assessment	
<b>Temperature, Air</b>	n/a	Field Measurement				
<b>Temperature, Water</b>	n/a	Field Measurement		X		
<b>Total Dissolved Gases</b>	Total	Field Measurement				
<b>Bromate</b>	Total	15541-45-4				
<b>Chlorine (Total Residual)</b>	Total	Field Measurement				
<b>Chlorite</b>	Total	14998-27-7				
						(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Cyanide</b>	Dissolved	57-12-5				
<b>Cyanide</b>	Total	57-12-5				
						Accompanying Air Temperature measurement
<b>Fluoride</b>	Total	16984-48-8				
<b>Hardness</b>	Dissolved	Calculated		X		

<b>Hydrogen Sulfide</b>	Total	7783-06-4			Accompanying Field pH Measurement	
					Accompanying Total Dissolved Solids measurements for Site-specific locations located on Ivie Creek and its tributaries from the confluence with Muddy Creek to the confluence with Quitchupah Creek, and Quitchupah Creek from confluence with Ivie Creek to U-10	
<b>Sulfate</b>	Total	14808-79-8				
<b>Total Dissolved Solids</b>	Total	n/a		X		
<b>BOD</b>	Total	n/a				
<b>Total Nitrogen</b>				X		
<b>Total Phosphorus</b>				X		
<b>Chlorophyll a</b>	Total	n/a		X	for Lake Samples only; Accompanying Secchi Depth	
<b>Chlorophyll a, uncorrected for pheophytin</b>	Total	n/a		X	for Lake Samples only; Accompanying Secchi Depth	
<b>Fillamentous algae cover</b>	n/a		X		for Headwater Numeric Nutrient Criteria ecological response; Accompanying Total Nitrogen and/or Total Phosphorus	
<b>Gross primary productivity</b>	n/a		X		for Headwater Numeric Nutrient Criteria ecological response; Accompanying Total Nitrogen and/or Total Phosphorus	
<b>Periphyton</b>	n/a		X		for Headwater Numeric Nutrient Criteria only	Must be expressed as a chlorophyll concentration or as ash free dry mass
<b>Ecosystem respiration</b>	n/a		X		for Headwater Numeric Nutrient Criteria ecological response; Accompanying Total Nitrogen and/or Total Phosphorus	
<b>Dissolved Oxygen (% Sat)</b>	n/a	Field Measurement				Recommend submitting Water Temperature

<b>Dissolved Oxygen (Concentration)</b>	n/a	Field Measurement	X	Please refer to the credible data requirements and DWQ's Call for Data Website.	Please refer to the credible data requirements and DWQ's Call for Data Website.
<b>Aluminum</b>	Dissolved	7429-90-5	X	Accompanying Field pH Measurement AND Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Antimony</b>	Total	7440-36-0			
<b>Arsenic</b>	Dissolved	7440-38-2	X		Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Arsenic (Trivalent)</b>	Dissolved	7440-38-2		O - DWQ unable to routinely measure this parameter due to analytical constraints	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Asbestos</b>	Total	1332-21-4			
<b>Barium</b>	Dissolved	7440-39-3	X		Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Beryllium</b>	Dissolved	7440-41-7	X		Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Boron</b>	Total	7440-42-8	X		
<b>Cadmium</b>	Dissolved	7440-43-9	X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Calcium</b>	Dissolved	7440-70-2	X	Accompanying Magnesium, Dissolved for Hardness calculation	Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Chromium</b>	Dissolved	7440-47-3	X		Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.

<b>Chromium (Hexavalent)</b>	Dissolved	18540-29-9	O - DWQ unable to routinely measure this parameter due to analytical constraints		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Chromium Trivalent</b>	Dissolved	16065-83-1	O - DWQ unable to routinely measure this parameter due to analytical constraints	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Copper</b>	Dissolved	7440-50-8	X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Iron</b>	Dissolved	7439-89-6	X		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Lead</b>	Dissolved	7439-92-1	X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Magnesium</b>	Dissolved	7439-95-4	X	Accompanying Calcium, Dissolved for Hardness calculation	Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.

<b>Mercury</b>	Dissolved	7439-97-6	X		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Nickel</b>	Dissolved	7440-02-0	X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Selenium</b>	Dissolved	7782-49-2	X		(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Silver</b>	Dissolved	7440-22-4	X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>Thallium</b>	Total	7440-28-0			
<b>Uranium</b>	Total	7440-61-1			
<b>Zinc</b>	Dissolved	7440-66-6	X	Accompanying Hardness or Calcium, Dissolved AND Magnesium, Dissolved Measurement	(1) The dissolved metals method involves filtration of the sample in the field, acidification of the sample in the field, no digestion process in the laboratory, and analysis by EPA approved laboratory methods for the required detection levels. (2) Recommended that the <b>Total</b> fraction result value is also submitted in the data package for QA/QC purposes.
<b>E. coli</b>	n/a	n/a	X		
<b>Beach Closures</b>		n/a			
<b>Drinking Water Closures</b>		n/a			

<b>Fish Kills</b>		n/a		
<b>Harmful Algal Blooms: Cyanobacteria cell density</b>		n/a	X - assessments on hold	X for Lake Samples only
<b>Harmful Algal Blooms: Cyanobacteria taxonomic composition (i.e., phytoplankton)</b>		n/a	X - assessments on hold	X
<b>Harmful Algal Blooms: Cyanobacteria toxin concentrations</b>		n/a	X - assessments on hold	X
<b>Nitrate as N</b>	Total and/ or Dissolved	14797-55-8		X
<b>Total Ammonia as N</b>	Total	7664-41-7		X
<b>Total Phosphorus as P</b>	Total	7723-14-0		X
<b>1,1,1-Trichloroethane</b>	Total	71-55-6		
<b>1,1,2,2-Tetrachloroethane</b>	Total	79-34-5		
<b>1,1,2-Trichloroethane</b>	Total	79-00-5		
<b>1,1-Dichloroethane</b>	Total	75-34-3		
<b>1,1-Dichloroethylene</b>	Total	75-35-4		
<b>1,2 -Trans-Dichloroethylene</b>	Total	156-60-5		
<b>1,2,4-Trichlorobenzene</b>	Total	120-82-1		
<b>1,2-Dichlorobenzene</b>	Total	95-50-1		
<b>1,2-Dichloroethane</b>	Total	107-06-2		
<b>1,2-Dichloropropane</b>	Total	78-87-5		

<b>1,2-Diphenylhydrazine</b>	Total	122-66-7
<b>1,3-Dichlorobenzene</b>	Total	541-73-1
<b>1,3-Dichloropropene</b>	Total	542-75-6
<b>1,4-Dichlorobenzene</b>	Total	106-46-7
<b>2,4,5-TP</b>	Total	93-72-1
<b>2,4,6-Trichlorophenol</b>	Total	88-06-2
<b>2,4-D</b>	Total	94-75-7
<b>2,4-Dichlorophenol</b>	Total	120-83-2
<b>2,4-Dimethylphenol</b>	Total	105-67-9
<b>2,4-Dinitrophenol</b>	Total	51-28-5
<b>2,4-Dinitrotoluene</b>	Total	121-14-2
<b>2,6-Dinitrotoluene</b>	Total	606-20-2
<b>2-Chloroethyl vinyl Ether</b>	Total	110-75-8
<b>2-Chloronaphthalene</b>	Total	91-58-7
<b>2-Chlorophenol</b>	Total	95-57-8
<b>2-Methyl-4,6-Dinitrophenol</b>	Total	534-52-1
<b>2-Nitrophenol</b>	Total	88-75-5
<b>3,3'-Dichlorobenzidine</b>	Total	91-94-1
<b>3-Methyl-4-Chlorophenol</b>	Total	59-50-7
<b>4,4-DDD</b>	Total	72-54-8
<b>4,4-DDE</b>	Total	72-55-9
<b>4,4'-DDT</b>	Total	50-29-3
<b>4-Bromophenyl Phenyl Ether</b>	Total	101-55-3
<b>4-Chlorophenyl Phenyl Ether</b>	Total	7005-72-3
<b>4-Nitrophenol</b>	Total	100-02-7
<b>Acenaphthene</b>	Total	83-32-9
<b>Acenaphthylene</b>	Total	208-96-8

Acrolein	Total	107-02-8
Acrylonitrile	Total	107-13-1
Alachlor	Total	15972-60-8
Aldrin	Total	309-00-2
alpha-BHC	Total	319-84-6
alpha-Endosulfan	Total	959-98-8
Anthracene	Total	120-12-7
Atrazine	Total	1912-24-9
Benzene	Total	71-43-2
Benzidine	Total	92-87-5
Benzo(a)Anthracene	Total	56-55-3
Benzo(a)Pyrene	Total	50-32-8
Benzo(b)Fluoranthene	Total	205-99-2
Benzo(ghi)Perylene	Total	191-24-2
Benzo(k)Fluoranthene	Total	207-08-9
beta-BHC	Total	319-85-7
beta-Endosulfan	Total	33213-65-9
Bis(2-Chloroethoxy)Methane	Total	111-91-1
Bis(2-Chloroethyl)Ether	Total	111-44-4
Bis(2-Chloroisopropyl)Ether	Total	39638-32-9
Bis(2-Ethylhexyl)Phthalate	Total	117-81-7
Bromoform	Total	75-25-2
Butylbenzyl Phthalate	Total	85-68-7
Carbofuran	Total	1563-66-2
Carbon Tetrachloride	Total	56-23-5
Chlordane	Total	57-74-9

<b>Chlorobenzene</b>	Total	108-90-7
<b>Chlorodibromomet hane</b>	Total	124-48-1
<b>Chloroethane</b>	Total	75-00-3
<b>Chloroform</b>	Total	67-66-3
<b>Chlorpyrifos</b>	Total	2921-88-2
<b>Chrysene</b>	Total	218-01-9
<b>Dalapon</b>	Total	75-99-0
<b>Di(2-ethylhexyl)adipate</b>	Total	103-23-1
<b>Diazinon</b>	Total	333-41-5
<b>Dibenzo(a,h)Anthra cene</b>	Total	53-70-3
<b>Dibromochloropro pane</b>	Total	96-12-8
<b>Dichlorobromomet hane</b>	Total	75-27-4
<b>Dichloroethylene (cis-1,2)</b>	Total	156-59-2
<b>Dieldrin</b>	Total	60-57-1
<b>Diethyl Phthalate</b>	Total	84-66-2
<b>Dimethyl Phthalate</b>	Total	131-11-3
<b>Di-n-Butyl Phthalate</b>	Total	84-74-2
<b>Di-n-Octyl Phthalate</b>	Total	117-84-0
<b>Dinoseb</b>	Total	88-85-7
<b>Dioxin</b>	Total	1746-01-6
<b>Diquat</b>	Total	85-00-7
<b>Endosulfan Sulfate</b>	Total	1031-07-8
<b>Endothall</b>	Total	145-73-3
<b>Endrin</b>	Total	72-20-8
<b>Endrin Aldehyde</b>	Total	7421-93-4
<b>Ethylbenzene</b>	Total	100-41-4
<b>Ethylene Dibromide</b>	Total	106-93-4
<b>Fluoranthene</b>	Total	206-44-0
<b>Fluorene</b>	Total	86-73-7

<b>gamma-BHC (Lindane)</b>	Total	58-89-9	
<b>Glyphosate</b>	Total	1071-83-6	
<b>Haloacetic acids</b>	Total	n/a	
<b>Heptachlor</b>	Total	76-44-8	
<b>Heptachlor epoxide</b>	Total	1024-57-3	
<b>Hexachlorobenzene</b>	Total	118-74-1	
<b>Hexachlorobutadiene</b>	Total	87-68-3	
<b>Hexachlorocyclohexane (Lindane)</b>	Total	58-89-9	
<b>Hexachlorocyclopentadiene</b>	Total	77-47-4	
<b>Hexachloroethane</b>	Total	67-72-1	
<b>Ideno 1,2,3-cdPyrene</b>	Total	193-39-5	
<b>Isophorone</b>	Total	78-59-1	
<b>Methoxychlor</b>	Total	72-43-5	
<b>Methyl Bromide</b>	Total	74-83-9	
<b>Methyl Chloride</b>	Total	74-87-3	
<b>Methylene Chloride</b>	Total	75-09-2	
<b>Mirex</b>	Total	2385-85-5	
<b>Naphthalene</b>	Total	91-20-3	
<b>Nitrobenzene</b>	Total	98-95-3	
<b>N-Nitrosodimethylamine</b>	Total	62-75-9	
<b>N-Nitrosodi-n-Propylamine</b>	Total	621-64-7	
<b>N-Nitrosodiphenylamine</b>	Total	86-30-6	
<b>Nonylphenol</b>	Total	84852-15-3	
<b>Oxamyl (vydate)</b>	Total	23135-22-0	
<b>Parathion</b>	Total	56-38-2	
<b>PCB's</b>	Total	1336-36-3	
<b>Pentachlorophenol</b>	Total	87-86-5	Accompanying Field pH Measurement

<b>Phenanthrene</b>	Total	85-01-8
<b>Phenol</b>	Total	108-95-2
<b>Picloram</b>	Total	1918-02-1
<b>Polychlorinated Biphenyls</b>	Total	1336-36-3
<b>Pyrene</b>	Total	129-00-0
<b>Simazine</b>	Total	122-34-9
<b>Styrene</b>	Total	100-42-5
<b>Tetrachloroethylene</b>	Total	127-18-4
<b>Toluene</b>	Total	108-88-3
<b>Toxaphene</b>	Total	8001-35-2
<b>Trichloroethylene</b>	Total	79-01-6
<b>Vinyl Chloride</b>	Total	75-01-4
<b>Xylenes</b>	Total	1330-20-7
<b>Tributyltin</b>	Dissolved	n/a
<b>Gross Alpha</b>	Total	12587-46-1
<b>Gross Beta (Combined)</b>	Total	12587-47-2
<b>Radium 226</b>	Total	13982-63-3
<b>Radium 228</b>	Total	15262-20-1
<b>Strontium 90</b>	Total	10098-97-2
<b>Tritium</b>	Total	10028-17-8

Please refer to appropriate method for QC requirements and to ensure that method sensitivity is sufficient to accurately quantify constituent concentration from natural waters

**NOTE:** This list and accompanying information may not be complete. Please check UAC R317-2 for the most current list of parameters and the 303(d) Methods for additional information on what parameters are assessed, readily available, and credible.

## Appendix 2

### **DATA QUALITY GUIDELINE EXAMPLES**

#### DWQ Sampling Analysis Plan Requirements

Revision 1.1 July 6, 2016

#### **Utah Division of Water Quality**

##### *Checklist of Essential Elements for Sampling and Analysis Plans (SAPs)*

Monitoring Project/Program: \_\_\_\_\_

Preparer(s): \_\_\_\_\_

Reviewer(s): \_\_\_\_\_

Date Submitted for Review: \_\_\_\_\_

Date of Review: \_\_\_\_\_

Parent QAPP or Equivalent Document: \_\_\_\_\_

##### *Instructions for Preparers:*

As required by DWQ's Quality Assurance Program Plan for Monitoring Programs (DWQ QAPP), **any monitoring activity** conducted or overseen by DWQ **must** have a SAP, excluding one-time response actions (such as a spill) or compliance sampling. The SAP must be reviewed and revised for each field season/monitoring year. SAPs are approved and kept on file by the Monitoring Section QA Staff and must be distributed to everyone involved with a monitoring project. Use the template and checklist below to help create your SAP. The SAP should contain or reference all the elements in this checklist but need not have the same format. Rather than extensive text, include as much information as possible in the form of tables, which are easier to refer to in the field.

The SAP should be a usable, stand-alone document that can be taken into the field by Monitors. Therefore, if you choose to use an element directly from the DWQ QAPP that needs to be viewable when reading the SAP, copy and paste it into the SAP rather than just referencing the QAPP so that Monitors do not have to read through both documents while in the field. The Monitoring- and Data and Information-Section's QA Staff are available to assist you in preparing your SAP and you may view other DWQ SAP examples on the Monitoring Council Webpage at <http://www.waterquality.utah.gov/Monitoring/Council>.

##### *Definitions and Acronyms:*

**DPM - Designated Project Manager.** As defined by DEQ's Quality Management Plan (QMP), the DPM is the staff member responsible for a specific project and has immediate managerial or technical control of that project. The DPM is responsible for specifying the quality of the data required for each project and initiating corrective actions when quality control is not being met. The DPM may also be a program manager. The DPM is responsible for designing monitoring strategies, setting project-specific data quality objectives (DQOs), and developing project-specific SAPs. DPMs are responsible for making sure all personnel involved with the project are briefed and/or trained on the procedures to be used. Roles of DPMs are further discussed throughout the DWQ QAPP.

IR –Integrated Report

## SMP – Strategic Monitoring Plan

### **Introduction and Background Information (This can be brief if it references some previous documentation or the IR or SMP, etc.)**

- Site history
- Regulatory framework
- Summary of previous investigations
- Location/characteristics of any known pollution sources at the site or in the area
- Site location map showing area at a broad scale

### **Objectives and Design of the Investigation (This should be very specific to the project and should be a result of discussions between DPM, data users, stakeholders, science panel, etc.)**

- Specific objectives of this study (describe how they support broader program goals/objectives or regulatory framework)
- Study design (i.e. spatial/temporal limits, sample characteristics, the smallest population, area, volume, or time frame for which decisions will be made).
- Representative sampling conditions and instructions for field personnel if they encounter non-representative sampling conditions
- Parameters of concern (narrative – must conform to list(s) in sections 4 and 6)
- Number, location, and frequency of samples and quality control samples
- Sampling Site Locations
- Rationale for site selection
- Site map(s) showing sampling locations and “control” sites and any other pertinent features such as land use, etc. within the sampling area

### **Special Precautions and Safety Plan**

- Detailed itemization of any specific safety concerns
- Reference to an applicable safety plan
- Any additional safety training required for project
- Documentation that field personnel comply with your Invasive Species Plan and SOPs to prevent spread of invasive species

### **Field Sampling Methods and Documentation**

- Any special training needed beyond those discussed in DWQ QAPP and where training documentation will be kept
- A table listing each field instrument to be used (equipment, describe operation or indicate where operation manual is kept for field event, include calibration procedures, if any)
- A table listing each sampling method to be used (sampling equipment if needed, cite method in SAP, attach applicable SOPs)
- Operation of any sampling equipment used or location of operation manual for field event, include decontamination procedures, if any, attach applicable SOPs
- Equipment lists and sampling trip organizing checklists if not found in SOPs
- Corrective actions for problems that may occur in the field
- Field documentation required and how field records shall be generated and stored

### **Laboratory Sample Handling Procedures**

- Sample containers, preservatives, holding times

- Field documentation (COC) and sample labeling procedures
- Shipping plan for sample transport to laboratory

### **Analytical Methods and Laboratory Documentation**

- Chemical – list parameter, cite preparation method and analytical method, list required sensitivity or detection limits
- Biological – cite method or desired taxonomic level and organism target count, etc.
- Required reporting procedures (e.g. hardcopy, electronic deliverables) and turn-around times
- Be sure DWQ has obtained QA documentation for each laboratory used (check with Monitoring Section QA Staff), reference this information and any new/research analytical methods being used (obtain these protocols if available from lab)
- List the required data package contents from the analyzing laboratories [or reference a service contract or Memorandum of Understanding (MOU)]

### **Project Quality Control Requirements**

- Table of QC limits for field instruments (operation range, accuracy, and precision)
- Table listing each Data Quality Indicator (precision, accuracy, bias, etc.), how it will be measured, and the performance criteria against which it will be evaluated (use the table in the DWQ QAPP and adapt it to this project if needed): (1) analytical (internal to lab) QC limits for chemical analyses (acceptable precision, accuracy, and negative control – lab method blank, (2) field sample QC limits for chemical analyses [Acceptable precision (field duplicates) and negative control (field or trip blanks)], and (3) QC limits for biological analysis [Acceptable precision (% diff in enumeration, 5 taxonomic difference)]
- QC limits, schedule, and descriptions of planned field/lab audits/assessments
- Data quality assurance review procedures: (1) describe system of data qualification, (2) describe measure of completeness relative to planned design, and (3) corrective actions for non-conformance

### **Data Analysis, Record Keeping, and Reporting Requirements**

- Data interpretation approach (include means to temper decision-making if limited completeness of design occurs)
- Project record keeping procedures and archive (hardcopies, electronic data)
- How and when DPM wishes to be notified of available laboratory/field results
- Expected content and format of final project report and who will receive original/copies.

### **Schedule and Budget**

- Table or figure showing project schedule with key project milestones
- List funding sources for project and include anticipated equipment, consumables, personnel purchases/costs
- Sample costs/lab resources per fee schedule

### **Project Team and Responsibilities**

- Project team responsibilities and personnel
- Sampling personnel
- Subcontractors (e.g. chemical and biological labs)

### **References (include references to DWQ-prepared documents)**

**Appendices and Attachments (include SOPs, chain of custody forms, field forms, sample labels, etc.)**

# Example Field Observation Form for Grab Samples

Version 2.0  
 Monitoring Location ID: \_\_\_\_\_  
 Monitoring Location Name: \_\_\_\_\_  
 Monitoring Location Description: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Sample Date: \_\_\_\_\_  
 Sample Times: \_\_\_\_\_

Check the water color description that best fits the sampling location:  
 Brown/Gray (turbid)    Black    Clear    Stained (tea-look)    Green    Other (describe) \_\_\_\_\_



---

Indicate the level of coverage of *Didymosphenia geminata* (didymo) in reach  
 Absent (0%)    Sparse (<10%)    Moderate (10-75%)    Heavy (>75%)



<-- Example of didymo  
 Photo from <http://www.wv.dnr.gov/fishing/didymo.shtm>

---

Indicate the level of coverage of Filamentous algae in reach  
 Absent (0%)    Sparse (<10%)    Moderate (10-75%)    Heavy (>75%)



<-- Example of filamentous algae  
 Photo from <http://www.dep.wv.gov/WWE/Programs/Pages/Pages/FilamentousAlgaeinWestVirginia.aspx>

---

(Lake sampling) Is there blue green algae?  Y  N



<-- Example of blue green algae  
 Photo courtesy of Utah County Health Dept

---

Is there an Algal Mat?  Y  N

Fish kill?:  Y  N

Number of Fish Observed: \_\_\_\_\_

Type of Fish: \_\_\_\_\_

Does the underside of the rock look black AND have a strong sulfur/rotten eggs smell?  Y  N

Sheen present?:  Y  N

Odor at the site?:  Y  N

---

Anthropogenic disturbances present at site that may affect sample results?  Y  N

---

If yes to any above, explain here: \_\_\_\_\_

---

Were any photos take from the site visit?  Y  N

---

Circle all weather codes that apply

1 Windy	4 Rain (presently
2 Dust	5 Runoff (indicate if you are sampling/ trying to capture runoff)
3 Rain in the last 24/48 hrs	

---

Circle all flow codes that apply

1 Standing Water (no flow BUT measurement/ sample taken	4 Shallow/trickie
2 Measurement/ sample taken from backwater	5 Ice Present: evidence of flow beneath surface
3 Swift and deep	6 Ice Present: unsure if flowing beneath surface

---

Circle all field condition codes that apply

1 Fire (evidence of)	4 Presently Flooding/ Water Rising	7 Beaver Dam (sample taken upstream)
2 Landslide/ Mudslide (evidence of)	5 Livestock (present)	8 Beaver Dam (sample taken downstream)
3 Flooding (evidence of)	6 Livestock (not present but evidence of)	9 Dam (sample taken downstream of resevoir tailrace)

---

FIELD COMMENTS: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

---

Other comments/concerns/issues: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Appendix 3

### **APPLICATION OF SECONDARY REVIEW PROCESS**

<b>Data Concern</b>	<b>Secondary Review Process</b>	<b>Data Application</b>
<b>Temporal variation within a dataset</b>	Insufficient sampling frequency within an assessment period of record	Individual data records
<b>Bias in sampling design</b>	(1) Event monitoring (review flow, weather, and spill/response/incident data; narrative criteria; field observations and photographs; satellite imagery; other data types collected in same (and around the) period of concern, etc.), (2) sample time of day (literature review to determine if parameter is impacted by the time of day sample is collected), (3) sampling a specific season (unless approved by DWQ in a SAP or is data-type specific (e.g., <i>E. coli</i> sampling during the recreation season)], (4) and locational bias	Individual data records
<b>Data quality</b>	(1) Quality Assurance Program Plan For Environmental Data Operations, (2) field calibration documentation, (3) laboratory methods, (4) standard operating procedures, (5) demonstration of capability (if applicable to data type), and (6) discussion with sample collector	Individual data records, and/or, parameter(s) in period of record, and/or monitoring location
<b>Wrongly monitored</b>	(1) Measured point source (vs. main water body), review imagery of area, flow, etc., (2) waterbody type DWQ does not assess, (3) grab sample vs. composite, (4) flow conditions (too low or not flowing), and (5) field observation that impacts quality of data	Individual data records and/or monitoring location
<b>Outlier</b>	(1) Need more than a statistical test. Should be based on scientific or QA basis, (2) QA/QC field sampling blanks, duplicates/replicate, (3) laboratory Analytical Batch QC, (4) value is nonsensical (e.g., cannot be measured with field/laboratory method), and (5) refer to data quality (above)	Individual data records
<b>Magnitude of exceedance</b>	(1) Significant figures and (2) narrative criteria review	Individual data records
<b>QA/QC concerns</b>	(1) Holding time, (2) laboratory comment, (3) dilutions, spikes, and (4) other laboratory QC performance checks	Individual data records

Data Concern	Secondary Review Process	Data Application
<b>Assessment unit grouping/spatial variation</b>	(1) Multiple locations not grouped correctly (either should or should not have been grouped), (2) AUs where water quality criterion exceedances are clearly isolated to a relatively small, hydrologically distinct portion of the larger AU and may need to be re-segmented to more accurately reflect that variation in water quality (please refer to 303(d) Assessment Methods section on “Assessment Unit Re-segmentation” for more information on the process), and (3) a surface water (e.g., a spring or seep) was sampled in the AU and was assessed but additional information indicates that the surface water may not have been flowing or did not connect, contribute, or influence downstream water quality	Monitoring location
<b>Credible data</b>	(1) Data type applied incorrectly and (2) data type not considered. (Data type must meet credible and representative data requirements in 303(d) Assessment Methods, and if included in the assessment analysis would result in a change in the categorization of the waterbody and parameter	Individual data records and/or parameter(s) in period of record, monitoring location
<b>Other</b>	(1) Parameters wrongly grouped (by CAS, fraction, or methods), (2) data type is laboratory measurement (when the data assessment requires a field measurement), (3) IR QA/QC flagged data, and (4) errors in standards	Individual data records. Entire parameter assessments
<b>Conflicting DO assessments between grab and high frequency data</b>	Scenario: Two types of data available at the site(s) (i.e., grab or high frequency data) do not have the same preliminary assessment result. Reviews to consider: (1) sampling period captured, (2) duration of conditions below criterion, (3) frequency of recurrent low DO events, (4) magnitude of exceedance, (5) spatial extent of low DO, and (6) diel flux of DO	Individual data records. Entire parameter assessments
<b>Representativeness and Environmental Factors*</b>	Examples of extreme events include the following: (1) accidental spills of toxic chemicals, (2) scouring storm flows that lead to diminished aquatic-life beneficial uses, and (3) extreme drought conditions. Given the scope of these assessments, it is not always possible to identify where such circumstances may be influencing a specific sample, but DWQ will consider any evidence presented that a sample is not representative of ambient conditions. Examples of such a review may include reviewing flow, weather, spill data, narrative criteria, field observations and photographs, satellite imagery, other data types collected in the same (and around the) period of concern, etc.	Individual data records

Data Concern	Secondary Review Process	Data Application
<p><b>Pollution Indicators</b></p>	<p>Secondary reviewers will incorporate indicator data into assessment category determinations, relying on multiple lines of evidence, including pollution indicator thresholds, the presence or absence of other indicator-associated water quality issues, potential pollutant sources, and other site or watershed-specific knowledge to determine whether listing or delisting on a pollution indicator parameter is appropriate or whether to prioritize waterbodies for additional monitoring.</p>	<p>(1) Pollution indicator evaluations will be posted with the report(s) (e.g. exceedance counts &amp; frequencies), so DWQ programs and stakeholders can consider the results when planning for future monitoring, studies, evaluations, etc, (2) pollution Indicator evaluations may be included in a narrative assessment/standard not supporting or supporting assessment decision, (3) pollution indicators may be reported by the IR as a cause of pollution impairment, and (4) pollution indicators may be reported by the IR as the source of an impairment</p>
<p>*Footnote: Where these conditions are present in a dataset, DWQ will run the analysis without the extreme events/data record and will apply and document an appropriate assessment result for the waterbody using the methods outlined below.</p> <p>Category 1: Supporting: If analyses with and without the extreme events are supporting (Category 1).</p> <p>Category 2: No evidence of impairment: If analyses with the extreme events are supporting (Category 1), but the analyses without the extreme events show no evidence of impairment (Category 2)</p> <p>Category 2: No evidence of impairment: If analyses with and without the extreme events do not indicate evidence of impairment (Category 2)</p> <p>Category 2: No evidence of impairment: If analyses with the extreme events are evidence of impairment (Category 3 with exceedances), but the analyses without the extreme events show no evidence of impairment (Category 2)</p> <p>Category 2: No evidence of impairment: If analyses with the extreme events are not supporting (Category 5), but the analyses without the extreme events show no evidence of impairment (Category 2)</p> <p>Category 3: Insufficient Data, Exceedances: If analyses with and without the extreme events show evidence of impairment (Category 3)</p> <p>Category 3: Insufficient Data, Exceedances: If analyses with the extreme events are not supporting (Category 5), but the analyses without the extreme events are supporting (Category 1)</p> <p>Category 5: Not supporting: If analyses with the extreme events are evidence of impairment (Category 3), but the analyses without the extreme events are not supporting (Category 5)</p> <p>Category 5: Not supporting: If analyses with the extreme events are not supporting (Category 5), but the analyses without the extreme events show evidence of impairment (Category 3)</p> <p>Category 5: Not supporting: If analyses with and without the extreme events are not supporting (Category 5)</p>		

## Appendix 4

### ***SUMMARIZING ASSESSMENTS FROM SITE TO ASSESSMENT UNIT LEVEL***

Going from multiple beneficial uses assessments for a parameter (i.e., a Parameter Summary Report) to One Parameter Category per Monitoring Location ID (MLID)\*.

#### **IR Analysis Action: 3: (Insufficient Data with Exceedances)**

- 1,2, or 3 exceedances (with no data rejected for a use). Param Cat: 3 insufficient data with exceedances → Param EPA Cat: 3
- 1,2, or 3 exceedances (with some data rejected for a use). Param Cat: 3 insufficient data with exceedances → Param EPA Cat: 3
- 0 exceedances (with no data rejected for a use). Param Cat: 3 insufficient data with no exceedances → Param EPA Cat: 3
- 0 exceedances (with some data rejected for a use). Param Cat: 3 insufficient data with no exceedances → Param EPA Cat: 3
- All data removed for every use. Param Cat: 3 insufficient data because not assessed → Param EPA Cat: 3

#### **IR Analysis Action: Not Assessed**

- All data removed for every use. Param Cat: 3 insufficient data because not assessed → Param EPA Cat: 3

#### **IR Analysis Action: Not Assessed**

- IR Analysis Comment: “Non-Rejected data available for MLID/AU, but data available for individual use assessment was all rejected.” Param Cat: 3 insufficient data because not assessed → Param EPA Cat: 3

#### **IR Analysis Action: Not Assessed**

- IR Analysis Comment: “No Uses assigned to site.” Param Cat: 3 insufficient data because not assessed → Param EPA Cat: 3

#### **IR Analysis Action: Assessed By Use**

- FS Only → Param EPA Cat: 1
- FS Only + some data rejected by use → Param EPA Cat: 2
- Contains an NS → Param EPA Cat: 5
- All data was rejected for a use → Param EPA Cat: 3, insufficient data because not assessed
- FS Only + exceedances by Use + some data rejected by use → Param Cat: 3 insufficient data with exceedances → Param EPA Cat: 3
- FS Only + no exceedances by Use + some data rejected by use → Param EPA Cat: 2
- FS Only + exceedances by Use + NO data rejected by use → Param Cat: 3 insufficient data with exceedances → Param EPA Cat: 3
- FS Only + no exceedances by Use + NO data rejected by use → Param EPA Cat: 2
- Exceedances by Use + some data rejected by use → 3 insufficient data with exceedances → Param EPA Cat: 3
- No exceedances by Use + some data rejected by use → 3 insufficient data with no exceedances → Param EPA Cat: 3

- Exceedances by Use + NO data rejected by use →3 insufficient data with exceedances →Param EPA Cat: 3
- No exceedances by Use (NO exceedances) + NO data rejected by use →3 insufficient data with no exceedances →Param EPA Cat: 3
- BOD, TP\*\*, and Nitrate (for non 1C uses) →Parameter Cat: MLID Cat =3 Further Investigations →Param EPA Cat: 3

\*Note: after this rollup there will be multiple parameter assessment categories for one MLID. For example, MLID “X” will have one Iron, one Copper, one Temperature, one Dissolved Oxygen, etc.

**Going from many Parameter Categories within an MLID to 1 Category for the MLID take MLID\_Param Cats and Group them by MLID. Then assign the MLID category by the following logic:**

- \*\*Parameter Cat = 5 →MLID Cat = 5 AND MLID EPA Cat = 5
- Parameter Cat = 3 with exceedances →MLID Cat =3 with exceedances AND MLID EPA Cat = 3
- Parameter Cat = 1 → (Cat1 Matrix Check is a match) →MLID Cat =1 AND MLID EPA Cat = 1
- Parameter Cat = 1 → (Cat1 Matrix Check is a NOT a match) → MLIDCat =2 AND MLIDEPACat = 2
- Parameter Cat = 2 →MLID Cat =2 AND MLID EPA Cat = 2
- Parameter Cat = 3 further investigations needed →MLID Cat =3 further Investigations Needed AND MLID Cat = 3
- Parameter Cat = 3 no exceedances →MLID Cat =3 no exceedance AND MLID EPA Cat = 3
- Parameter Cat = 3 not assessed →MLID Cat =3 no assessed AND MLID EPA Cat = 3

\*\* Should be able to see a concatenation of the uses for a parameter that created a Category 5 (needs validation too)

**Going from many MLID Categories within an Assessment Unit (AU) to 1 Category for the AU take MLID Cats and Group them by AUID. Then assign the AUID category by the following logic:**

- \*\*MLID Cat = 5 →AUID Cat = 5 AND AUID EPA Cat = 5
- AUID Cat = 5 (and TMDL in Place) →AUID Cat = 5 AND AUID EPA Cat = 4A
- AUID Cat = 5 (and non-TMDL in Place) →AUID Cat = 5 AND AUID Cat = 4B
- \*\*MLID Cat = 5 → (and TMDL is in place & only parameter assessed for that AUID is being considered) →AUID Cat = 4a AND AUID EPA Cat = 4A
- AUID Cat = 5 (and non-TMDL in place) →AUID Cat = 4a AND AUID EPA Cat = 4B
- \*\*MLID Cat = 5 → (and non-TMDL is in place & only parameter assessed for that AUID is being considered) →AUID Cat = 4b AND AUID Cat = 4B
- MLID Cat = 3 with exceedances →AUIDCat =3 with exceedances AND AUID EPACat = 3
- MLID Cat = 2 →AUID Cat =2 AND AUID EPA Cat = 2
- MLID Cat = 1 →AUID Cat =1 AND AUID EPA Cat = 1
- MLID Cat = 3 further investigations needed →AUID Cat =3 further investigations needed AND AUID Cat = 3
- MLID Cat = 3 no exceedances →AUID Cat =3 no exceedances AND AUID Cat = 3
- MLID Cat = 3 not assessed →AUID Cat =3 not assessed AND AUID Cat = 3

\*\* Should be able to see a concatenation of the uses for a parameter that created a 5 category (needs validation too)

Extra Checks: Biological assessments only assess 3A, 3B, 3C, or 3D beneficial uses. For an AU to be Category 1, all assigned beneficial uses must be assessed. Query AUs with biological assessments in them and confirm that the AU assessment category follows the roll up process described in this document. One example: a biological assessment is performed for an AU and the AU is Category 1 (should be changed to a Category 2).

## Appendix 5

### ***4B SUBMISSION POLICIES AND PROCEDURES: PROCESS FOR DETERMINING CATEGORY 4B CLASSIFICATION***

An approved Category 4B demonstration plan is an alternative to listing an impaired segment on the state's 303(d) list. A Category 4B demonstration plan, when implemented, must ensure that all applicable water quality standards are met through agreed-upon pollution-control mechanisms within a reasonable time period. These pollution-control mechanisms can include approved compliance schedules for capital improvements or plans enforceable under other environmental statutes (such as Comprehensive Environmental Response, Compensation, and Liability Act) and their associated regulations. A Category 4B demonstration can be used for segments impaired by point sources and/or nonpoint sources. Both DWQ and EPA must accept a Category 4B demonstration plan for the affected segment to be placed in Category 4B. In the event that the Category 4B demonstration plan is not accepted, the segment at issue will be included on the 303(d) list, Category 5.

Generally speaking, the following factors will be considered necessary for Category 4B demonstration plan acceptance: 1) appropriate voluntary, regulatory, or legal authority to implement the proposed control mechanisms through permits, grants, compliance orders for Utah Pollutant Discharge Elimination System permits, etc.; 2) existing commitments by the proponent(s) to implement the controls; 3) adequate funding; and 4) other relevant factors appropriate to the segment.

The following evidence must be provided as a rationale for a Category 4B demonstration plan:

#### ***A statement of the problem causing the impairment***

1. A description of
  - a. The pollution controls to be used
  - b. How these pollution controls will achieve attainment with all applicable water quality standards
  - c. Requirements under which those pollution controls will be implemented
2. An estimate of the time needed to meet all applicable water quality standards.
3. A schedule for implementation of the necessary pollution controls.
4. A schedule for tracking progress, including a description of milestones.
5. A commitment from the demonstration plan proponent to revise the implementation strategy and pollution controls if progress toward meeting all applicable water quality standards is not shown.

#### ***Timing for proposal submittal and acceptance by DWQ and EPA***

- Category 4B demonstration plans should be submitted to DWQ by July 1 of even numbered years, in order for DWQ to submit the plan to EPA by September 1 of even numbered years. Parties are encouraged to work with DWQ before this date as states are the entity required to submit these plans to EPA.
- Acceptance from EPA must be obtained by October 31 of even numbered years; otherwise, DWQ will continue to propose that the segment in question is included on the current cycle's 303(d) list.
- If EPA and DWQ accept the Category 4B plan, DWQ will notify the Water Quality Board and the public through proposed statement of basis and purpose language in its proposal that a Category 4B demonstration plan is accepted and is appropriate for this segment.

EPA has several documents that contain additional information on Category 4B demonstration requirements, including: [“2006 Integrated Report Guidance”](#); and [“Information Concerning 2008 Clean Water Act Sections 303\(d\), 305\(b\), and 314 Integrated Reporting and Listing Decisions”](#).

## Appendix 6

### Guidelines

**Does the AU/AU-parameter combination warrant further investigation? (See 303(d) Assessment Methods for more details).**

**What was the original cause of impairment for the AU?**

**What IR assessment cycle was the AU and parameter first listed?**

- What datasets were used for that listing (e.g., the agency/sample collector)?
- What was the period of record? (If unknown, use the longer period of record).
- What MLIDs are in the AU?

**For impairments listed in the previous assessment cycle, compile the data. (Query data for all MLIDs in the AU. Ignore waterbody types).**

- What MLID has  $\geq 1$  exceedances?
- For MLIDs with impairments/exceedances and not assessed in the current IR cycle: why did DWQ (or someone else) not resample? (Provide documentation as to why resampling was not done and why (by not re-sampling) the site should meet water quality standards. Please refer to the good cause descriptions in the 303(d) methods. Check for good cause. If it is a reason other than good cause, the documentation will need to be EPA-approved).
- Where all MLIDs with exceedances are assessed in the current IR cycle: (1) For MLIDs with impairments/exceedances and the current parameter assessment for the MLID is not 1, 2, or 3 no exceedances  $\rightarrow$  no delisting or (2) is the current parameter Category 1, 2, or 3 no exceedances? Was there a secondary review applied to this parameter (e.g., an assessment category overwrite for the whole):
  - a. Parameter? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is considered to be a delisting. Check for good cause.
  - b. MLID? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is considered to be a delisting. Check for good cause.
  - c. AU? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is considered to be a delisting. Check for good cause.
- Is the current parameter Category 1, 2, or 3 no exceedances? (No secondary review applied to this parameter)  $\rightarrow$  Check for good cause.

Note: Need to confirm that if no new data are collected, the new assessment analysis is not a Category 1,2, or 3 no exceedances, because the exceedances are out of the period of record for assessment analysis (i.e., not a delisting).

**Double check before delisting:**

- If the current Parameter Category 1, 2, or 3 no exceedances – what is the oldest date in that period of record for that MLID/Parameter combo in the current assessment cycle?
- For every MLID in the AU (ignore waterbody types), compile all data for that parameter between the max date from the cycle the parameter was first listed and the oldest date in that period of record for that MLID/Parameter combo in the current assessment cycle?
- What MLID has  $\geq 1$  exceedances

- For MLIDs with impairments/exceedances and not assessed in the current IR cycle: why did DWQ (or someone else) not resample? (Provide documentation as to why resampling was not done and why (by not re-sampling) the site should meet water quality standards. Please refer to the good cause descriptions in the 303(d) methods. If it is a reason other than good cause, the documentation will need to be EPA-approved). Check for good cause.
- Where all MLIDs with exceedance are assessed in the current IR cycle: (1) for MLIDs with impairments/exceedances and the current parameter assessment for the MLID is not 1, 2, or 3 no exceedances → no delisting or (2) is the current parameter Category 1, 2, or 3 no exceedances? Was there a secondary review applied to this parameter (e.g., an assessment category overwrite for the whole):
  - d. Parameter? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is considered to be a delisting. Check for good cause.
  - e. MLID? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is considered to be a delisting. Check for good cause.
  - f. AU? If the secondary review created a Category 1, 2, or 3 no exceedances, the secondary review justification will need to be EPA-approved if it is considered to be a delisting. Check for good cause.
- Is the current parameter Category 1, 2, or 3 no exceedances? (No secondary review applied to this parameter) → Check for good cause

Note: Need to confirm that if no new data are collected, the new assessment analysis is not a Category 1,2, or 3 no exceedances, because the exceedances are out of the period of record for assessment analysis.

### ***EPA DELISTING CODES***

<b>Delisting Reason Code</b>	<b>Comment</b>
<b>WQS_NO_LONGER_THREATENED</b>	Applicable WQS attained; threatened water no longer threatened
<b>WQS_NEW_ASMT_METHOD</b>	Applicable WQS attained, according to new assessment method
<b>DELISTING_4C</b>	Not caused by a pollutant (4c)
<b>DELISTING_WQS_NOT_APPLICABLE</b>	WQS no longer applicable
<b>DELISTING_4B</b>	Other pollution control requirements (4b)
<b>DELISTING_4A</b>	TMDL Approved or established by EPA (4a)
<b>WQS_NEW_DATA</b>	Applicable WQS attained; based on new data
<b>WQS_LISTING_INCORRECT</b>	Applicable WQS attained; original basis for listing was incorrect
<b>REFINEMENT</b>	Clarification of listing cause
<b>WQS_RESTORATION_ACTIVITIES</b>	Applicable WQS attained, due to restoration activities
<b>WQS_RECOVERY_UNSPECIFIED</b>	Applicable WQS attained; reason for recovery unspecified
<b>DELISTING_NOT_IN_JURISDICTION</b>	Listed water not in state's jurisdiction
<b>WQS_STANDARDS_CHANGED</b>	Applicable WQS attained, due to change in WQS
<b>NOT_SPECIFIED</b>	Not specified
<b>DELISTING_NOT_WATER_OF_STATE</b>	Water determined to not be a water of the state
<b>DELISTING_ORIG_INCORRECT</b>	Data and/or information lacking to determine WQ status; original basis for listing was incorrect

## Appendix 7

### ***TMDL PRIORITIZATION PROCESS***

The Clean Water Act (CWA) requires total maximum daily loads (TMDLs) be developed for all impaired waterbodies on the 303(d) list. The CWA recognizes the many limitations in data, time, and staff resources to accomplish this, so the statute also requires states to prioritize where they will dedicate resources toward TMDL development. However, defining an impaired waterbody as high priority does not necessarily mean that a TMDL will be developed before lower priority segments. Development of some high-priority TMDLs may take considerably longer due to data collection, stakeholder involvement, and other factors.

DWQ prioritizes impairments to human and ecological health as described in the [Division of Water Quality's \(DWQ\) 303\(d\) vision document](#). These priorities translate into the protection and restoration of waters designated for culinary, recreational, and aquatic life uses. Considerations for TMDL prioritization in Utah also include the level of partner agency and stakeholder involvement and potential for restoration as defined by the Recovery Potential Screening tool. Other factors considered in setting TMDL priorities include programmatic needs such as permitting and addressing watershed-wide water quality issues.

## Appendix 8

*RESPONSE TO PUBLIC COMMENTS (TO BE INSERTED)*